Vol. XII.
No. CCLXX.

JANUARY 27, 1883.

Price Fourpence.

FEB 9 1883

HARVARD COLLEGE

THE ELECTRICAL REVIEW

3 LONDON: PUBLISHING OFFICE, 22, PATERNOSTER ROW, E.C.
New York: D. Van Nostrand, 23, Murray Street, and 27, Warren Street. Paris: Madame Veuve J. Boyveau, Librairie Etrangère, 22, Rue de la Banque. Berlin: A. Asher & Co., 5, Unter den Linden.

JOHNSON & PHILLIPS,
TELEGRAPH ENGINEERS, ELECTRICIANS, AND CONTRACTORS.
OFFICE: 14, UNION COURT, OLD BROAD STREET, LONDON, E.C.
WORKS: VICTORIA ROAD, CHARLTON, LONDON, S.E.

Manufacturers of all Telegraph Appliances, Materials, and Machinery for Making and Laying Submarine Cables, and Contractors for Underground & Aerial Telegraphs.

Iron and Steel Telegraph Buoys, Grapnels, both Patent and Ordinary; Centipedes, Creepers, Mushrooms, Sinkers, Cable Tanks, Picking-up and Paying-out Machinery, Dynamometers, Bow and Stern Gear, Steam and Hand Hauling Gears, Rope and Chain Fittings, Cable Drums, Splicing and Jointing Tools, &c., &c.

Machinery Designed and Constructed for the Complete Equipment of Telegraph Cable Factories and Vessels. Wire Testing Machines for Tension, Elongation, and Torsion. Special Wire Sounding Machines for Shallow and Deep Water.

All Apparatus and Material used in the Construction and Maintenance of **LAND LINES**, viz.:—

INSULATORS—*Johnson & Phillips'* Patent Fluid Insulators, and all kinds of the ordinary form, Shackles, Shackle Straps, &c.

BATTERIES—Sole Makers of *Higgins'* Patent Bichromatic Batteries, and all the ordinary forms. Contractors for the supply of Zinc and Carbon Battery Plates of special quality.

POLES—Wrought Iron or Composite Poles of various kinds, for Telegraph, Telephone, and Electric Light purposes.

Makers of Special Underground Torpedo and Field Cables, with Single or Multiple Cores.

Insulated Copper Wires, Strand and Ropes, taped or braided, cotton or silk covered.

ELECTRIC LIGHT—Makers of Electric Lamps.

Every description of Leading WIRES and CABLES. CARBON RODS, both Black and Coppered.

GOLD MEDAL 1881, PARIS ELECTRICAL EXHIBITION.

THE "PILSEN"-JOEL AND GENERAL ELECTRIC LIGHT COMPANY,
LIMITED.

PATENTEES AND MANUFACTURERS OF
THE PILSEN ARC LAMP, THE JOEL SEMI-INCANDESCENT LAMP, AND THE GATEHOUSE INCANDESCENT LAMP.

Manufactory: THE MALDEN FACTORIES, KENTISH TOWN, N.W.,
H. F. JOEL, A.M.I.C.E., Engineer.
E. T. GREGORY, Secretary. JAMES FYFE, Managing Director.

OFFICES—ST. STEPHEN'S CHAMBERS, MOORGATE STREET.

Contractors to H.M. Postmaster-General, the Indian Government, the principal Railway, Telephone, and Electric Light Companies.

ESTABLISHED 1868.

WALTER T. GLOVER & Co.,
Telegraph Wire and Cable Makers,
25, BOOTH STREET, MANCHESTER.

COPPER OF HIGH CONDUCTIVITY
FOR ELECTRICAL PURPOSES.
MANUFACTURER—J. O. MOUCHEL, 10, RUE COMMINES, PARIS.
SOLE AGENTS FOR ENGLAND—

DAVIS AND TIMMINS,
BOWLING GREEN LANE, FARRINGDON ROAD,
LONDON, E.C.

THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. XII.—No. 270.

ON THE MODE OF WORKING OF DYNAMO-ELECTRIC MACHINES.

UNDER this heading we reproduced, in the ELECTRICAL REVIEW of the 13th inst., an article from the pen of M. Aug. Guerout, in *La Lumière Electrique*, showing that the counter-electromotive force developed by the ring of a dynamo has no other cause than the rotation of the ring itself, a fundamental fact which many persons ignore, and which some even now dispute. The question is sufficiently interesting for us to add a few remarks to the article of M. Guerout and to correct a material error in the paragraph below, which we reproduce *in extenso:*

"M. Frœlich considers this phenomenon as a kind of attraction of the magnetism of the ring by the rotation. M. Marcel Deprez explains it by saying that the ring is subjected to two magnetic actions, one due to the influence of the poles A and B, the other to the action of the current-circulation round the ring. These two actions produce a magnetic resultant for which the neutral magnetic line takes the position indicated to be given to the brushes."

The explanation attributed incorrectly by the writer to M. Marcel Deprez is far from being new, and we find it developed for the first time in a remarkable investigation by M. Antoine Breguet, on the *Théorie de la machine de Gramme*, published in 1879 in the *Annales de Chimie et de Physique* (5th series, Vol. XVI.). The title itself shows the object of this study.

Recherches sur la théorie de la machine de Gramme, sur la cause de la position dissymétrique de ses frotteurs, et, incidemment, étude des écrans magnétiques.

In this work the young *savant* has given the complete explanation of the multiple actions which together cause the production of the current in the Gramme machine, and has shown in what *direction* it is best, in each case, to change the position of the brushes, and to what *degree*, according to the function of the different elements. We here give the formula established by M. Antoine Breguet to calculate this angle, referring the reader to the original memoir for greater developments.

"Calling:

C_m, the intensity of the magnetic field (a function of the current circulating in the wires of the inductors);

C_g, the intensity of the galvanic field (produced by the current circulating in the armature);

R, the resistance of the circuit;

Δ, the angular displacement to be given to the diameter of commutation in relation to the direction of the origin, that is to say, perpendicular to the lines of force of the field, considering the reciprocal actions of the magnetic field and of the galvanic field to be zero.

We know (see the memoir) that, for

$$\begin{cases} C_m = 0 \text{ we have } & \Delta = 90^\circ \\ C_m = \infty & \Delta = 0^\circ \end{cases}$$

$$\begin{cases} C_g = 0 & \Delta = 0^\circ \\ C_g = \infty & \Delta = 90^\circ \end{cases}$$

$$\begin{cases} R = 0 & \Delta = 90^\circ \\ R = \infty & \Delta = 0^\circ \end{cases}$$

These limits are required in order to enable such a general expression of the value of Δ to be found as will give, with sufficient approximation, the value corresponding to the particular values of the magnetic and galvanic fields, and of the total resistance of the circuit.

This expression is as follows:—

$$\text{tang. } \Delta = \frac{C_g}{\text{tang. } (R, C_m)}$$

When, *the direction of rotation being the same*, the machine is employed as an electro-motor, then as a source of current, the galvanic field, C_g, changes its sign with the sign of the current. This formula shows plainly, as it should, that the displacement of the brushes ought to be effected in the opposite direction, for Δ becomes negative.

M. Breguet has verified by experiment the enormous influence which the relative values of the two fields may have upon the position of the brushes, amplifying the intensity of the galvanic field in relation to that of the magnetic field; he has been able to obtain displacements of nearly seventy degrees.

There results from this displacement and from these mutual reactions of the fields a sufficiently interesting fact; it is, that the curve to which M. Marcel Deprez has given the name of *caractéristique* is far from showing from the working of the machine the exact useful indications which the author attributes to it. This fact, which implicitly existed in the work of M. Antoine Breguet long before M. Marcel Deprez introduced the word *caractéristique* into scientific language, was pointed out for the first time, we believe, by M. Cabanellas.

In fact, this is how M. Marcel Deprez constructs the *caractéristique* of a machine: the machine turns at a given and constant speed, we excite the inductors with a gradually-increasing current, and note for each intensity the corresponding electromotive force developed by the bobbin. The current of excitation is measured by an ampère-meter, and the electromotive force by a voltmeter of fine wire. Under these conditions it is quite evident that the galvanic field is sensibly equal to zero, because the great resistance of the voltmeter allows a very weak current only to pass in the armature, whilst the magnetic field increases up to saturation of the electro-magnets. We are, therefore, in the case supposed by Antoine Breguet of $C_g = 0$, for which $\Delta = 0$, the position of the brushes ought to be such that the points of contact are found sensibly upon the diameter perpendicular to the lines of force.

When, after having thus traced the *caractéristique*, we re-establish the communication between the bobbin and the inductors the same current will traverse both wires; complex reactions will result which necessitate changing the position of the brushes for each intensity, and nothing will authorise us to conclude, as M. Marcel Deprez does, that in these new conditions the reciprocal reaction of the two fields will not influence the electromotive force developed by the machine, and that it will be always that given by the *caractéristique*. Theory and experiment prove that it is quite otherwise in fact; this is evident if we revert to the memoir already quoted and which, criticising the experiments made by MM. Mascart and Angot in 1878 upon a Gramme machine, show how the results obtained differ according as the method of measurement is based upon a variable galvanic field, or upon the opposition methods in which the galvanic field is always *nil* and the position of the brushes invariable.

It follows from what we have just said that the question of the dissymmetry of the brushes of the Gramme machine was studied and formulated by Antoine Breguet in 1879, that his labours have brought forward the importance of the reciprocal actions of the magnetic and galvanic fields, and shown incidentally that the conclusions which can be drawn from the study of the *caractéristique* of a machine should only be accepted with the greatest reserve.

The Crompton Step-wound Armature.—Some of the English scientific newspapers have published this special mode of winding the flat armatures of continuous current machines as presenting special and novel features. Our readers will remember, however, that this arrangement was devised, employed, and published for the first time by M. Plücker, capitaine d'artillerie, at Anvers (Belgium), who presented the machine at the Royal Academy of Belgium at the beginning of 1882. A description of this machine, with illustrations, appeared in *L'Electricien* of June 15th, 1882, and in the pages of this Journal a week later. It appears, however, probable that Mr. Crompton's application for his patent was made prior to any publication of the Plücker machine in England.

LIGHT MOTORS AND BATTERIES.

Experiments by M. GASTON TISSANDIER.

THE investigations undertaken by M. Tissandier interest to an equal extent aeronauts and electricians, but it is chiefly from the point of view of these latter that we will analyse the results obtained by our *confrère*. We know that the results hitherto obtained for the direction of balloons have not been very brilliant, if we except the experiment made in 1852 by M. Giffard.

Attracted by the difficulties of the problem, M. Tissandier has undertaken to solve it, taking advantage of the recent progress of science. The interest and the novelty of these experiments consist chiefly in the choice of the motive-power destined to actuate the propeller. In fact, M. Tissandier has had recourse to electrical motors. These motors have the following advantages for aerial navigation:—Absence of fire, constancy of weight, and incomparable facility of putting in motion and arresting the mechanism. The lightness of the motor was obtained by the aid of a Siemens machine of special construction, and that of the source of electricity by the aid of bichromate of potash batteries.

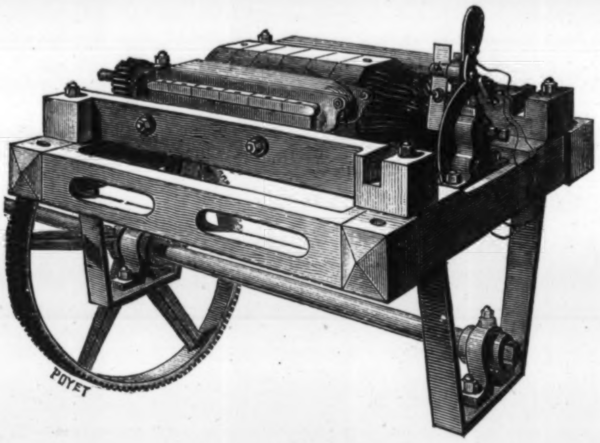

FIG. 1.

Siemens' Dynamo-electric Machine.

The Motor (fig. 1).—The motor is a Siemens continuous current dynamo, of a new design, constructed from the plans of M. George Boistel, Engineer of the Maison Siemens of Paris. It is characterised by the lightness of its component parts and the very elongated form of the armature, which has the effect of diminishing the relative value of the resistance of the wires which pass over each end of the drum. The position of the brushes is variable, and the inductors are included in the general circuit. The armature transmits its motion to the screw by means of a pinion and wheel; the relation of the velocities is as 1 to 10; therefore, when the motor makes 1,200 revolutions the screw makes 120. Experiments made upon the machine at different velocities and with various current intensities showed that the machine can furnish as much as 100 kilogrammetres per second ($1\frac{1}{2}$ H. P.), measured at the brake, with a current of 45 ampères and a difference of potential of 40 volts at the terminals. Under these conditions a very simple calculation shows that the machine only transforms into work about 55 per cent. of the electrical energy which is actually supplied to it. The lowness of this return is due to several causes, and a remedy has been devised, so that the return may easily attain 70 to 75 per cent., which is very satisfactory when we have to deal with an effective return resulting from *direct measurements* and not theoretical considerations, whose accuracy is often more than disputable.

The mode of measurement adopted consisted of measuring the electrical energy supplied to the machine by the formula

$$W = \frac{E\,I}{9 \cdot 81}$$

(W representing the work in kilogrammetres, E, the difference of potential at the terminals of the machine in volts, I, the intensity of the current in ampères), and in the determination of the mechanical work produced by the motor by making it absorb this work by the dynamometrical balance of M. Raffard. The electrical energy was measured by the aid of an ampère-meter and a volt-meter of M. Marcel Deprez.

Comparative measurements made by means of the volt and ampère-meters of Messrs. Ayrton and Perry, constructed and graduated in England, gave results which agree perfectly with those given by the apparatus of M. Deprez, constructed in France by the Maison Breguet.

The experiments showed that, when the machine works with a current of 45 ampères and 40 volts at the terminals *thirty per cent.* of the total energy supplied was absorbed for the maintenance of the magnetic field in the inductors. By exciting the inductors separately it was found that 32 ampères sufficed to saturate them. There was therefore a real *waste* of energy for the production of the magnetic field, which was diminished by omitting one layer of wire on the inductors. This modification allowed of working under the same conditions of work and velocity with fewer elements, and consequently with a better return.

The source of electricity.—M. Tissandier thought, in his first experiments, of using electrical accumulators, but this source presents, at least for this particular application, the inconvenience of not discharging itself rapidly enough, that is to say, of only furnishing a weak delivery. It is necessary, in fact, that in a period varying between two and three hours, the source of electricity should furnish all of which it is capable, and from this point of view accumulators are found inferior to bichromate batteries. After a minute investigation, and a long series of experiments upon the nature of the liquid, the form, and nature of the cells, the size and thickness of the plates of zinc and carbon, their number, &c., M. Tissandier devised a type of bichromate batteries with concentrated liquid, which, with a weight of seven kilogrammes per element, can furnish a current of 50 ampères for two hours, the electromotive force being about two volts, and the internal resistance not exceeding 0·01 of an ohm. The elements established in the aerostatic laboratory of M. Tissandier at Point du Jour are 24 in number, and arranged in four series of six elements each (fig. 3). The liquid required to fill each series is placed in a copper tank coated with lead communicating, by means of a ramified tube, with the ebonite boxes which serve for receptacles. By raising one of the tanks by the aid of small pulleys, we can fill the corresponding series and put it in action immediately; on lowering it the liquid runs off and the series is emptied.

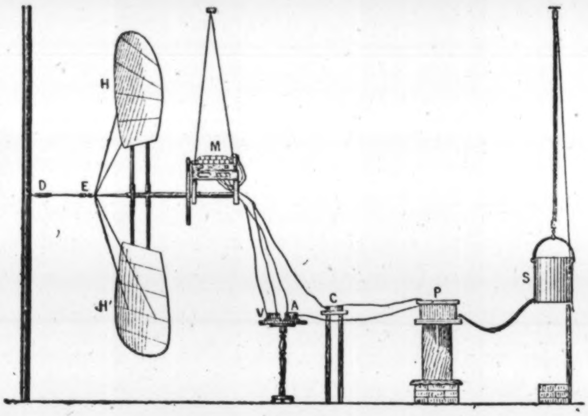

FIG. 2.

Diagram of the arrangement of the apparatus for the experiments of M. Tissandier.

S. Tank containing solution of bichromate of potash.
P. Batteries.
C. Commutator.
A. Ampère-meter.
V. Volt-meter.
M. Dynamo.
H. H'. Screw.
E. Swivel.
D. Balance.

A commutator varies the number of series which actuate the motor, and a volt and ampère-meter show at every moment the electrical energy supplied. The machine

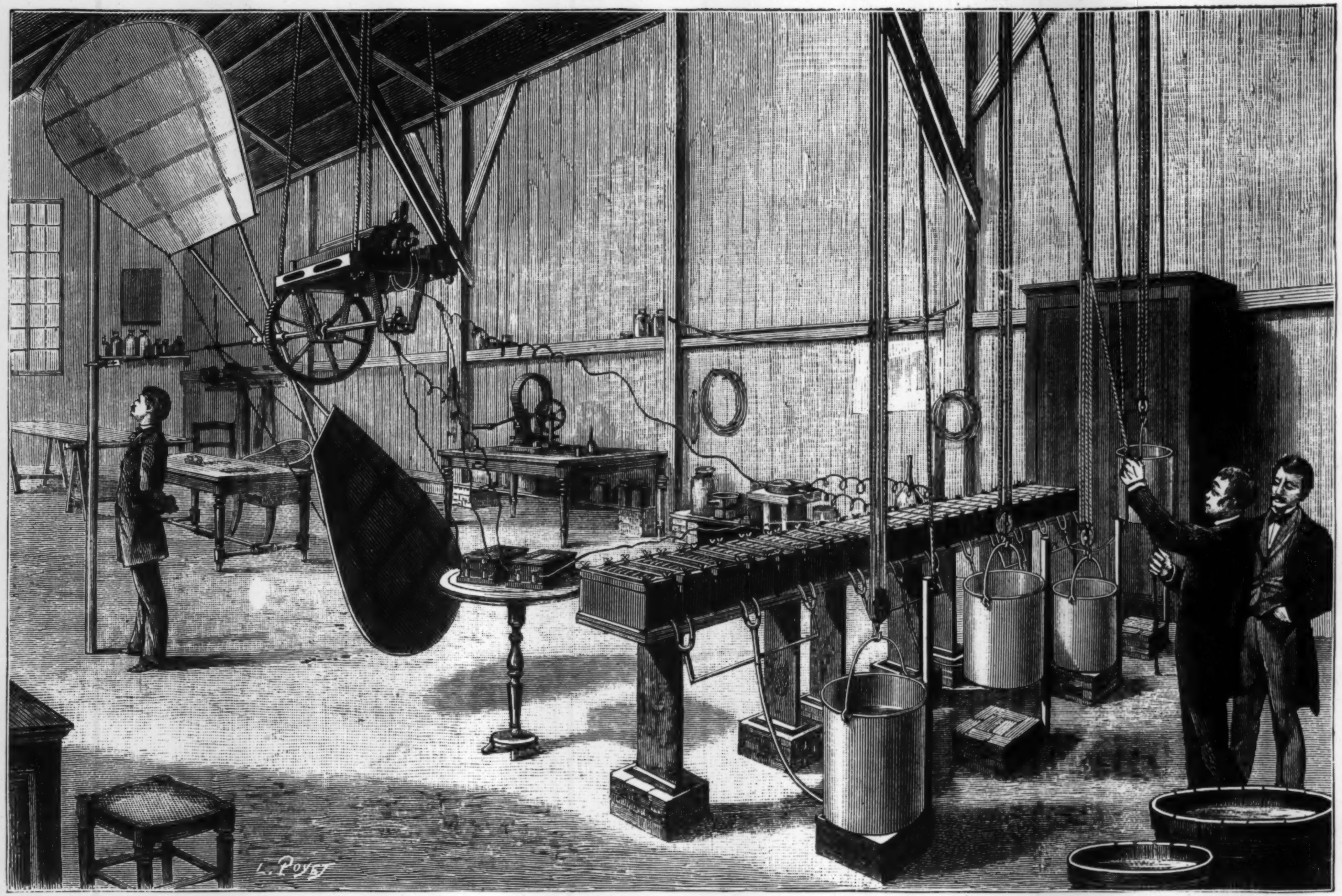

FIG. 3.—Aerostatic Laboratory of MM. Tissandier Frères.—Complete View of a Two-bladed Screw Propeller worked by a Siemens Dynamo and Battery of Light Bichromate of Potash Elements. (From a Photograph.)

is suspended to a longitudinal beam by cords; the screw is fixed upon the lower axis; the static effort exerted by the rotation of the screw is measured by the aid of a spring balance attached at one end to a fixed point, and at the other, by a thin metallic wire and a swivel, to the extremity of the revolving arbor of the screw. Precautions are taken that the centre of gravity of the machine may remain always in the vertical plane passing through the points of suspension, in order that the horizontal component due to the inclination which it might take without these precautions, may not influence the indications of the balance (see the diagram and description, fig. 2). The screw constructed from the plans of M. Tatin is 2·85 metres ($9\frac{1}{2}$ ft.) in diameter, and has a pitch equal to its external diameter; it is formed of two blades made of silk varnished with gum-lac, stretched upon a frame furnished with two spokes of pine, with laths of the same wood, and an axle-box fixed upon these laths. With 12 elements in series the screw turns at the rate of 80 revolutions per minute and exerts upon the balance a pull of five kilogrammes; with 18 elements the speed is 120 revolutions and the pull seven kilogrammes; with 24 elements in series the speed of rotation reaches 150 revolutions and the pull nine kilogrammes.

It results from the experiments that the motor, without exceeding, with the generator, a total weight of three men, is capable of furnishing regularly during a period of three consecutive hours the work of 12 to 15 men, that is to say, 75 to 100 kilogrammetres. This motor only requires, for raising it in the air with two or three travellers, a balloon of the small capacity of about 900 cubic metres. An elongated balloon of about nine metres diameter in the centre, and 27 metres length, constructed of silk, inflated with pure hydrogen, is amply sufficient. Under the action of the propeller such a balloon would have in calm air a velocity of about four metres per second, or 15 kilometres per hour in round numbers. Very often the speed of the wind in calm weather is below this figure; in this particular condition of the atmosphere, this balloon could deviate sensibly from the line of the wind, go backwards or forwards, and perhaps return to the place of its departure.

M. Tissandier, satisfied with the results furnished by the batteries and motor which present all the desired lightness (of course the system disposed under the balloon would be arranged quite differently to the battery in the experiments which we have just described), is busy with the construction of a pure hydrogen gas apparatus capable of furnishing 1,000 cubic metres in a few hours; he will then construct an elongated balloon to receive the screw and its electro-motor.

We shall closely follow these very interesting experiments (which M. Tissandier makes at his own expense, without any idea of gain, and with a purely scientific object), and shall endeavour to keep our readers informed of the results obtained.

Electrical Advertising.—There might have been seen lately in the boulevards and principal streets of Paris an advertising cart upon the panels of which could be read, in black upon a transparent ground which was brilliantly illuminated, the addresses of several business houses which are noted or seek to become so. The carriage is a low truck, upon which are placed frames covered with white cloth on which the announcements in question are painted. In the interior of the vehicle and hidden from view is an electrical regulator arc lamp supplied by Faure accumulators charged daily at the factory. This regulator, on a new system, arranged to work notwithstanding the jolting, stoppage, and shocks of the vehicle, is also, if our information is correct, an invention of M. Camille Faure, but we have not yet had the opportunity of examining it closely.

A New Apparatus for Electrical Measurement.—To describe this apparatus as new is inadequate, we should call it unexpected, marvellous; judge of this from the announcement alone: Electrometrical balance for weighing electricity as we weigh gold (*sic*). The electrometric balance gives the electromotive force of batteries and line (?) currents. The inventor, M. E. de Baillehache, by a singular coincidence, lives at rue *Ampère*, in Paris.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Letters, &c., for the "Correspondence" columns should arrive not later than Tuesday morning if they are desired to appear in the following number, such communications to be addressed to the "Editors," ELECTRICAL REVIEW, 22, Paternoster Row, London, E.C.

Letters respecting Advertisements, Subscriptions, &c., should be sent to the "Publisher," ELECTRICAL REVIEW, at above address.

SUBSCRIPTION RATES.

THE ELECTRICAL REVIEW can be had, by order, from any newsagent in town or country; or it can be supplied direct from the office on the following terms (payable in advance):—

Half-yearly (postage included)	9s. 9d.
Yearly ,, ,, ...	19s. 6d.

FOREIGN SUBSCRIPTION RATES.

To all foreign countries (except those mentioned below):—

Half-yearly (postage included)	10s. 10d.
Yearly ,, ,, ...	21s. 8d.

Exceptions:—Abyssinia, Aden, Borneo, Ceylon, India, Java, Labuan, Mozambique, Penang, Persia *viâ* Brindisi, Philippine Islands, Singapore, Zanzibar, to which places the rates are:—

Half-yearly (postage included)	11s. 11d.
Yearly ,, ,, ...	23s. 10d.

Vol. XI., handsomely bound, in cloth, gilt, now ready. Vols. 1, 2, 5, 6, 7, 8, 9, 10, can likewise be had.

A few complete sets also may yet be obtained. Prices on application to the Publisher.

Cloth cases for binding THE ELECTRICAL REVIEW supplied.

ADVERTISEMENTS.

The rates for Advertisements may be obtained on application to the Publisher, ELECTRICAL REVIEW, 22, Paternoster Row, London, E.C.

Cheques and Post-office Orders (on Chief Office, London) to be made payable to H. ALABASTER.

CORRESPONDENCE.

Electro-motors.

PROF. THOMPSON has not thought it worth his while to verify or to disprove by experiment my assertion that an equal amount of energy is generated in a battery having a motor included in its circuit, whether the motor is running or not. He has written a letter instead, on which, with your permission, I shall say a few words.

He expresses his regret that I should fail to see the uselessness of his proving over again what was proved forty years ago, and thinks that no amount of evidence that he could pile up would convince me.

If I had been convinced by what is to be found in every text-book treating on the subject of motors, I should not have troubled your readers with my suggestions; but I do say that could he have proved to me that in a case where the action of a motor reduced the current to one-tenth, the consumption of zinc was correspondingly small, I should most certainly have been convinced that my suggestions were without any foundation and that the text-books were right.

In the same number of the ELECTRICAL REVIEW in which Prof. Thompson's letter appeared, I gave the results of some tests I made with the view of satisfying myself on the point. I hope they will be repeated by others; a Griscom motor, a battery, an ammeter, and a pair of scales are easily procurable, and I have no doubt that results similar to mine will be obtained. These results clearly point to the following conclusions: that the fall of current does not mean a diminution of energy to a like extent; that the action of the motor produces an augmentation of E. M. F., or a tension, which may be likened to a weight raised and kept in suspense by mechanical power; that, theoretically, the product of this tension and the observed current remains the same whether the motor is running or not; that this theoretical value is modified by certain counteractions within the motor producing a real counter-E. M. F., which partly destroys the current, and that this counter-E. M. F. depends on the principle on which the motor is constructed and may have very different values in different motors.

It appears that I was wrong in supposing that by "efficiency *per se* (*i.e.*, the ratio of the mechanical power a motor performs to the electrical power it absorbs)" Prof. Thompson meant the efficacy or the effectiveness of a motor, as distinguished from the efficiency of a system.

Prof. Thompson must, of course, know best what he meant by his own phrase, and if I have wrongly translated his efficiency *per se* into efficacy, or effectiveness, I humbly beg his pardon, but in extenuation of my error I may plead that I naturally supposed that a reply to a letter should have some reference to that letter, and if he did not allude to effectiveness in a motor in his reply, *I did* in my letter, and very plainly implied it when I said, in effect, that mere efficiency was no measure of the effectiveness (*i.e.*, usefulness and value) of a motor, and that efficiency did not form a sound basis upon which rules and standards for comparing the merits of different motors could be constructed. This is as true now as it was before Prof. Thompson wrote one syllable in reply.

To show the way in which Prof. Thompson treats my communications I shall quote a paragraph of his last letter, which relates to an experiment I described, with two motors: No. 1 with a high, and No. 2 with a lower efficiency, the latter being the more powerful of the two. I stated that by winding the armature of No. 2 to a resistance suitable to the battery, its efficiency could be made as great as that of No. 1, and that thereby its lifting power would be made still greater. This is what Prof. Thompson says:—"As to motors being wound to a 'resistance suitable (!) to the battery,' that expression has no meaning unless one knows how the resistance is obtained. One inch of thin platinum wire may offer as much resistance as a mile of thick copper wire. Which of these 'resistances' would be 'suitable' to a battery of—but stay, Mr. Immisch has not favoured us with any data as to the number of cells in his battery, or as to its electromotive force or its internal resistance."

There is nothing new or startling in his statement that one inch of thin platinum wire may offer as much resistance as a mile of thick copper wire. I knew that twenty years ago. I did not give any data as to the E. M. F. and internal resistance, simply because I did not consider it necessary. My doing so would not have served any purpose whatever.

I remember that Prof. Thompson, in his lecture, explained the comparatively feeble action of some motors—which he set spinning round—by saying that the source of power was not suitable to the resistance of the motors. Whatever may be said of the *fact* under the circumstances, the *explanation* was perfectly satisfactory and sufficient. Why should it be less sufficient for me to say that the armature of motor No. 2 could be wound to a resistance suitable to the battery? Does Prof. Thompson doubt that this could be done? No one who has even the slightest idea of motor work could possibly misunderstand my meaning; it would be patent to every one that mere resistance was not the thing to be aimed at, but longer and thinner wire of the same material, which means more convolutions of wire, and greater magnetic force, and greater resistance, simply as a matter of course.

Surely, it ought not to have been necessary to point this out to Prof. Thompson, who is himself engaged in motor work, but it is a well-known and well-worn trick in controversy—to raise side-issues, and to give to a mere nothing the appearance of importance, in the hope that it may "go down" with at least some people. Any one not well acquainted with the subject, on reading this laboured and would-be-sarcastic paragraph, would be led to suppose I had committed an egregious blunder, because, forsooth, I did not give the number of cells, &c. There are other passages in the letter provocative of being similarly analysed. I shall refrain from doing so, as I do not consider that any real good can be served by it, and I shall, in future, not take any notice whatever of what, in my opinion, tends to the same end.

I have now to refer to the concluding paragraph of Prof. Thompson's letter, which runs as follows: "The lamp experiment of Mr. Immisch exactly supports the accepted theory of a counter-E. M. F. What he observes is exactly that which he would get if for his moving motor he were to substitute a battery of equal internal resistance and offering an equal counter-electromotive force to the main line battery. I thank him for having given me so apt an experiment in demonstration of the point."

I can only say that if in any of his future lectures he should explain this lamp experiment by the theory of counter-electromotive force that explanation would be wrong. I invite your readers to picture to themselves, on the one hand, a "system having a battery on one end of the line and a motor on the other," and, on the other hand, a battery having a real counter-electromotive force introduced into the main circuit by means of an opposing battery. The power of the latter is of such proportion to that of the main-line battery, that the remaining current is of a strength that a lamp introduced as a shunt should glow with an intensity equal to that of another similar lamp introduced also as a shunt between the brushes of the moving motor in the other system. They are glowing with equal brightness, and they consume an equal amount of energy, but there is that difference between the two that, whereas I have shown in describing my experiment that the brightness of the lamp increases with the speed of the motor, an increase of the power of the opposing battery would diminish and destroy the light. I could not have wished for an example more apt to demonstrate the fallacy of the theory of counter-electromotive force, and I venture to say that had these two experiments suggested themselves to the authorities whom Prof. Thompson has named in his letter that theory would never have been heard of.

Moritz Immisch.

119, Toriano Avenue, N.W.

[We would refer our correspondent to articles on the Griscom Motor in the ELECTRICAL REVIEW of Sept. 23rd and 30th of last year. Also to others in our columns of the 13th inst., page 26, and in the present issue.

He will there find mention of the counter-electromotive force which he doubts, and of the existence of which Prof. S. Thompson cannot apparently convince him.—EDS. ELEC. REV.]

Dynamo-Electric Machines.

I shall be glad if you will kindly insert the following, *re* The Elphinstone-Vincent Dynamo. Since the first set of experiments made with the water-resistance is about all in the communication about the above that I am personally responsible for, I should be glad to know why experiments arranged as shown in fig. 2 should not "appear to you even to be reliable where a water-resistance is used." I had an idea that if simultaneous readings of ampères and volts were taken it would give the energy given out, and that it did not matter whether that energy was given out in the shape of heat, magnetism, or chemical action.

With regard to the *electrical* efficiency, this can be determined without direct experiments, and is purely a question of resistances, of armature, field-magnets, and external circuit.

Francis J. Mudford

(*Electrician, Messrs. Paterson & Cooper*).

77, Mildmay Grove, N.,
January 23rd, 1883.

[Does Mr. Mudford think that there is no difference between his water-resistance and an ordinary wire-resistance? In the one case we have the resistance only to take int account, but in the other we surely have an opposing electromotive force in addition to the resistance, whatever the latter may be, and therefore the results of efficiency will be somewhat erroneous.—EDS. ELEC. REV.]

Electrical Accumulators.

With your permission I would call your attention to some serious inaccuracies in the circular recently issued by the Electrical Power Storage Company, which you published on the 20th inst. What is meant by the following sentence?—"The accumulator should be charged with 400 ampères of current; then when 300 have been withdrawn, 330 (300 ?) should be put in again." As employed here the expression 300 ampères has no physical meaning whatever, for obviously the quantity of electricity passing through the accumulator is meant, and the figures ought to refer to coulombs or *ampère-hours*.

Another sentence reads as follows:—"When the accumulator is properly used, as hereafter described, the effective return is 90 per cent. of the electrical energy stored." The word *effective* lays this statement open to criticism. I presume the intention is to convey the idea that 90 per cent. of the energy expended in overcoming the E. M. F. of the accumulator during the charge is given up in the lamps during the discharge. Taking the resistance of the one-horse-power cell as ·0125 ohm, we have discharging with a current of 40 ampères ·5 volt expended in overcoming the resistance of the cell, and the ratio of work given out in the lamps to work done in the chemical formation of the cell is (2·15 — ·5) to 2·15, or 72 *per cent.* Taking into account the resistance of the cell in charging, we have as the ratio of work expended in the lamps to the total work done in sending the current through the cells (2·15 — ·5) to (2·15 + ·3125) when charging with a current of 25 ampères, or 67 *per cent.* Accepting, then, the figures given by the Electrical Power Storage Company—supposing the plates to absorb the whole of the gas generated—the efficiency of the accumulator cannot theoretically be more than 67 per cent. I question whether it reaches in practice 40 per cent.

The rule given for finding the proper number of cells for an accumulator is simple and—incorrect. Take an example: For lamps requiring 45 volts the accumulator (see table) consists of 22 cells, the total E. M. F. being 22 × 2·15 = 47·3 volts. The resistance of this accumulator is ·0125 × 22 = ·275 ohm. Putting on 28 Swan glow lamps of 35 ohms resistance each, we have a total current somewhere between the figures given and an external resistance of 1·25 ohm. Calling e the E. M. F. at the terminals of the lamps, we have

$$e = \frac{47{\cdot}3 \times 1{\cdot}25}{1{\cdot}25 + {\cdot}275} = 38{\cdot}7 \text{ volts.}$$

so that, instead of having 45 volts for our lamps we should only have, taking the rule given by the company, 38·7.

It is really a pity that companies engaged in the electric lighting industry will not take more trouble to provide the public with trustworthy information. For the most part their circulars are utterly unreliable. What is the use of telling a buyer that an accumulator of 22 cells will light his lamps when they require 26 cells? Surely such a policy is shortsighted. Apologising for the length of this letter.

E.

[In the beginning of the above letter the (300?) referred to was inserted by us as a query. 330 is the figure given in the company's circular, but this, however, does not alter the meaning of our correspondent's remark. We do not follow the calculation in the latter part of his letter, nor do we recognise that the company referred to adopts the policy ascribed to it by "E."—EDS. ELEC. REV.]

PROCEEDINGS OF SOCIETIES.

The Society of Telegraph Engineers and of Electricians.

Inaugural Address by WILLOUGHBY SMITH, President.

AFTER a few preliminary remarks, the President said: Each branch of natural philosophy has progressed in proportion to the advancement made from time to time in the accuracy of the instruments and appliances required for observations or measurements; no branch has benefited more in that respect than that in which we are individually and collectively so immediately interested. There can be no doubt but that the time has arrived that the whole subject of the electrical units requires a careful re-investigation. At the present time we are fast returning to the position we held before the formation of the British Association committee. It has been for some time, and still is, possible to purchase, for commercial purposes, copper of a higher specific conductivity than that of the recognised standard for pure copper. The proceedings of the committee appointed at the Electrical Congress held in Paris in September, 1881, to consider the whole matter and to definitely settle an international and permanent system should have been watched with much interest. The time, however, at the disposal of the committee was limited, and taking into consideration the place in which the meetings were held and the various other attractions of the exhibition, it is not surprising that but little progress was made on the subject beyond a few simple resolutions, which were promptly and unanimously adopted. The third proposition was "that the unit resistance (ohm) be represented by a column of mercury, having a square millimètre of section at the temperature of zero degree centigrade."

Before the appointment of the committee by the British Association, in 1860, this unit was known as Siemens' mercury unit, and was fast being recognised; but the committee rejected it on the ground that it was arbitrary, varying, of no practical advantage, and formed part of no coherent system of general electrical measurements. Allowing the weber to be rechristened ampère was, no doubt, due to a spirit of conciliation which could do no harm; but if this sudden change of the character of the unit were done in the same spirit it might lead to inconvenience hereafter. To the practical electrician the material standard, not the definition, is the important point; consequently the next proposition—"that an international commission should be intrusted with the ascertaining by a new set of experiments for practical purposes the length of column of mercury, having a section of one square millimètre, at the temperature zero degree centigrade, which shall represent the value of the ohm"—was of more interest. The members of that commission met in Paris early in November last, and after passing several resolutions adjourned for twelve months. The adjournment is, I presume, to allow time for desired experiments; so that when the members reassemble they will be prepared to publish their report, which, it is to be hoped, will embrace the whole question of units and fix them on a sound and lasting basis. In order to better illustrate the necessity of fresh measurements I will direct your attention to Table I.

TABLE I.

Samples of Copper.	CONDUCTIVITY.		
	First Test.	Second Test.	Third Test.
A	101·4	101·1	101·02
B	44·7	44·87	44·51
C	98·7	99·63	98·64
D	101·3	100·2	101·14
E	18·7	18·63	—

The figures show the specific conductivity of five samples of copper wire, assuming that of pure copper to equal 100, as given by Dr. Mathessen, viz., 100 inches of annealed pure copper, weighing 100 grains, has a resistance of 0·1516 ohms at 60° Fahr. The tests were made by three persons, each one making his tests quite independently and by means of his own apparatus and method. The results show that with good apparatus and careful manipulation very accurate and reliable tests can be made. They also show what great differences there are in the specific conductivity of ordinary commercial copper and confirm what I have already mentioned, that some commercial copper has a higher specific conductivity than the long recognised standard for pure copper.

Late in the year 1837 Professor Faraday proved by actual experiment that different kinds of matter possessed different inductive capacities, and wrote of "The Specific Inductive Capacity of Dielectric Bodies." We of to-day use the same language, but our correct knowledge of the subject is very limited, and I believe a careful investigation of the whole matter at the present time would be most valuable. It is customary to consider the specific inductive capacity of air = 1, and to compare the relative capacities of other substances with it. Thus it is often stated—

Air = 1.
India-rubber = 2·8.
Gutta-percha = 4·2.

Now in 1870 I showed that in specially-prepared gutta-percha its specific inductive capacity was reduced nearly equal to, if not below that of, india-rubber, and from that date the inductive capacity of the gutta-percha used for submarine telegraphy has been considerably reduced. When two metals are combined to form an alloy the resistance of the alloy is in most cases greater than that calculated from the resistance of the component metals and their proportions. I have reason to believe that compounded dielectrics follow the same law, not only in their resistance, but also in their electrostatic inductive capacity; therefore here is a subject which might also be investigated with advantage. In addition to the electrical resistance and electrostatic capacity of dielectrics there is the phenomenon termed electrification, absorption, or polarisation. These are synonymous terms, as they all express the same thing. I am sure it would be of great advantage if we could agree to adopt only one of these terms—polarisation, for instance—as by doing so it would prevent confusion and make our meaning less bewildering to our students and other persons. All dielectrics polarise, but in different degrees; in fact, polarisation varies, not only in different materials, but in different qualities of the same material, and also according to its condition. For instance, age and temperature affect polarisation very materially; therefore the formula and tables of co-efficients given in text-books and elsewhere for polarisation are not only unreliable in certain cases, but misleading, especially when applied to certain dielectrics employed in the construction of condensers or as the insulating medium in submarine or subterranean telegraphy. The resistance of gutta-percha increases gradually by age; observations extending over twelve years do not enable me to assert that its *maximum* resistance has been reached within that time.

The figures in Table II show the increase of resistance of the

TABLE II.

Date.	Dielectric resistance. Megohms.	Inductive capacity. Microfarads.
February, 1869	214	·385
March, ,, ...	261	·386
April, ,, ...	302	·389
May, ,, ...	328	·391
February, 1870	371	·395
December, 1876	585	·414
November, 1882	632	·419

gutta-percha surrounding one mile of a copper conductor with the dates when tested. Induction also gradually increases in a similar way as shown. No doubt both these conditions arise from the contraction of the gutta-percha round the wire, for if careful measurements were made it would be found that the diameter decreases in proportion to the increase in its inductive capacity. Had more frequent tests been taken than are here shown, at temperatures varying from 32° to 100° Fahr., it would still have been found that each series would differ from the other in polarisation, resistance, and induction, and that the formula applied to one series would not be correct for any one of the others. To obtain accurate measurements in experiments of this kind it is essential that a constant electromotive force should be employed, but unfortunately I know of no means by which such a force can be maintained; for although great and important improvements have been, and still are being, made in batteries, there has not yet, to my knowledge, been produced one that combines all the essential elements for constancy.

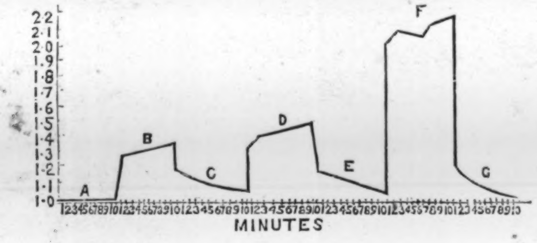

Fig. 1.

It is now nearly ten years since I first called attention to the wonderful effects light, and especially solar light, has on the electrical qualities of selenium; but to the present time we have not been able to realise any one of the results which, I feel sure, will ultimately arise from it; for where there is absorption of light, whether of dark or visible rays, by any body, work of some description must have been performed in that body. Of all the endeavours to utilise this property of selenium the photophone appeared the most promising; but, knowing what I did of the behaviour of selenium, I was not sanguine of its application for the purpose proposed, for as electricity acts by what we know as induction on a dielectric, so does the action of light act on selenium; that is to say, it absorbs slowly and as slowly gives gives it back. My meaning will perhaps be more intelligible by reference to Fig. 1. A bar of selenium in a small room from which all light was excluded was connected by means of insulated wires to a battery of 100 cells and an astatic mirror galvanometer in an adjoining room. The vertical figures represent the ratios of the galvanometer deflections obtained. While the light was excluded the deflection remained quite steady for ten minutes, as shown at A, but on exposing the bar to the light from an ordinary wax candle placed one metre from the bar the deflection immediately increased from 1 to 1·4, and then continued slowly increasing until at the end of ten minutes it reached 1·45, as shown at B. Immediately the light was extinguished the deflection fell to 1·2, and during the next ten minutes gradually fell to 1·09, as shown at C. The candle was then replaced by a Swan lamp, made incandescent by the current from thirty pint Grove cells, and supposed to have an illuminating power of twenty-five candles. The deflection at once increased to 1·51 and during ten minutes gradually farther increased to 1·66, as shown at D. On extinguishing the light the deflection immediately fell to 1·27 and during the ten minutes fell to 1·12, as shown at E. Dull solar light was then admitted through an ordinary window, and the deflection at once rose to 2·13 and during the ten minutes further increased, but not so uniformly as when under the influence of the previous source of light, to a *maximum* of 2·21, as shown at F. The variations in the deflections noticed in this case were due to atmospheric changes, producing a varying intensity of light. On again excluding the light the deflection immediately fell to 1·43 and during the next ten minutes further fell to 1·26, as shown at G. It is evident that it would have taken a much longer time to fall to its normal condition of 1. The fact of having to combine other metals with selenium to obtain a low resistance, which was stated to be essential to the photophone, was also contrary to my experience of its behaviour under the influence of light, but gentlemen eminent in electrical science having assured me that they had, not only seen, but had heard photophone, made me doubt the correctness of the results of my own experiments. Time has, however, proved that the results then being obtained were not due to the action of light on selenium but to the then unknown fact that thin discs or diaphragms of various materials become sonorous when exposed to the action of an intermittent beam of light. A discovery that has opened a new field for philosophical inquiry and further experiments have, I believe, shown that the effects produced are not due to light but to radiant heat. To obtain our present knowledge of terrestrial magnetism, observatories had to be established in all the most important parts of the world to record every movement or manifestation, regular and irregular, of that phenomenon. Might not our knowledge be considerably increased also if a similar system could be applied to the investigation of "earth currents" by the aid of the telegraph wires, which at the present time extend north, south, east, and west over the world, thus bringing to a focus a number of observations, which taken singly are of no value, but when collected and examined by competent men, cannot fail to produce beneficial results?

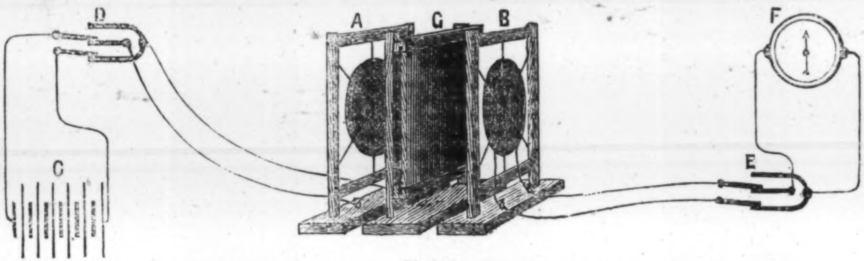

Fig. 3.

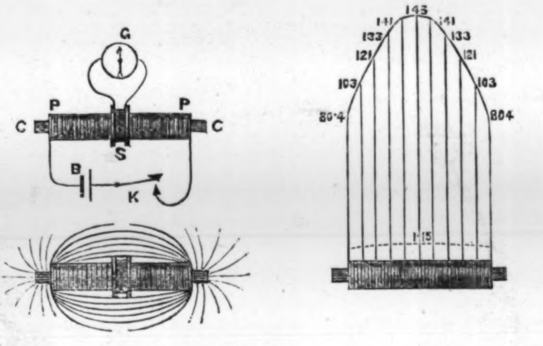

Fig. 2.

It is worthy of note that although Faraday obtained the first spark by induction from what he termed a common magnet capable of sustaining a weight of 100 lbs., he on the following day obtained better results from a loadstone capable of sustaining a weight of only 30 lbs. It is generally known that the power of a magnet is always increased by the reaction of another body in which it induces magnetism, and it is the same in a marked degree with the loadstone. If a piece of soft iron be applied to different parts of a small stone which I have in my possession, then, as a rule, where any considerable attraction takes place but little free magnetism is shown by the iron; but if no attraction exists then free magnetism is manifested at the end of it. At the present time the minds of practical electricians are more or less occupied in endeavouring to produce strong magnetic fields for developing high electrical currents for illuminating purposes. In the construction of machines for such purposes no doubt it is desirable to employ copper wire of the highest conductivity, but it is not so certain as to the quality of the iron best suited to the purpose. It has been asserted on good authority that the worst iron produces the best results; and I venture to think that we have not yet arrived at the best way of placing the wire to obtain the *maximum* strength of secondary currents from electro-magnets. The results of an ex-

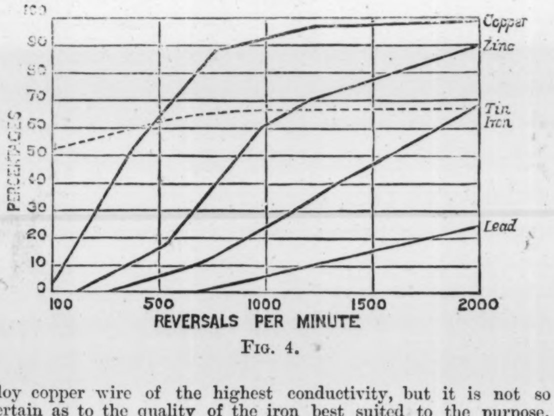

Fig. 4.

periment made to ascertain the relative strength or capability of producing inductive effects at different parts of a straight electro-magnet is shown by fig. 2, in which C C represents the iron core, P P the primary coil, connected at pleasure to one Grove cell, B, by means of the key, K. A small secondary coil, S, is free to move along the primary coil while in circuit with the galvanometer, G. The relative strength of any particular spot could be thus obtained by moving the coil, S, exactly over the required position and then noting the deflection obtained on G when the primary circuit was closed by depressing the key, K. The figures over the continuous curve represent the deflections obtained when the soft iron core was used; and the figure over the dotted line that obtained when a wooden core was substituted for the iron. I have lately shown by published experiments with a flat spiral that it is necessary to place the second coil, which is to be the receiver of inductive effects, in such a position that the lines of force cut it at right angles in order that the greatest effect may be produced. The effect diminishes as the lines of force cut it more obliquely. An exactly similar result occurs in this experiment for, as shown in fig. 2, the small secondary coil is only cut at right angles when it is placed in the centre of the magnet, and as it is moved towards either pole so the lines of force cut it more and more obliquely. From this it would appear that the results obtained are not purely dependent upon the strength of that portion of the magnet over which the secondary coil is placed, but principally upon the angle at which the lines of force cut the coil when so placed. It does not, therefore, follow that the centre of a magnet is its strongest part, as the result of the experiment at first sight appears to represent it to be. In my published experiments, first referred to, on what I termed specific inductive resistance, the instruments employed in one of the experiments were arranged as shown in fig. 3. A and B represent two flat spirals of silk-covered copper wire fixed a suitable distance apart, A being in circuit with the battery C and reverser D, whilst spiral B is in circuit with a similar reverser, E, and an astatic mirror galvanometer, F. As the two reversers were made to work in unison it will be readily seen that the currents induced in spiral B by A would always be in the same direction in the galvanometer circuit, and accordingly a steady deflection was obtained proportional to the inductive effect received by B. A plate of the metal under examination was then placed midway between the spirals at G and the fall of the galvanometer deflection noted, this fall being due to the interception by the metal of the inductive lines of force. It was found that the results varied in a remarkable degree according to the number of reversals per minute, each metal having its own characteristic. These experiments have been continued, and the results are to me so very interesting that I have ventured to place some of them before you this evening. In fig. 4 the vertical column of figures represents percentage of inductive radiant energy intercepted, and the horizontal row of figures the number of reversals per minute. The various lines represent the results obtained, with each metal examined, and it will be seen that copper, though unable to intercept to any extent the inductive lines of force when a slowly intermittent current is flowing in spiral A, fig. 3, is able to arrest 98 per cent. when the reversals are sufficiently rapid. It will be readily seen that the iron behaves in a different manner to the other metals, and that in a greater or less degree every metal has its own characteristic. The metals not only intercept the rays of inductive energy by means of absorption but bend them from their original path, and the amount of this refraction varies, as might be expected, with each metal, and also with the rapidity of the reversals in the inducing spiral. The refraction was measured by means of two flat spirals—one in connection with a battery and reverser, as spiral A, fig. 3—and the other or receiving spiral in circuit with the reverser and galvanometer, as shown at B in the same sheet, but in this case the receiving spiral was placed in a position parallel to the lines of force and consequently was unaffected by them until by placing the metal under examination in the field refraction took place, and the lines of force being then no longer parallel to the receiving spiral induced a current therein proportional to the refraction produced. Copper has the greatest refractive power, and iron, except for low speeds of the reverser, the least; and also in the case of iron the refraction remains almost unchanged for any speed, so that here again we have a marked contrast between iron and the other metals. I merely mention these facts in passing, but hope at some future date to bring them more prominently before you.

Although many eminent men of science have long noted the analogy between lightning and electricity, it was reserved for Franklin to demonstrate its identity by a bold experiment in which he proved that lightning and electricity were one, and consequently obedient to the same laws. Franklin at once conceived the idea of protecting buildings and other high structures from the effects of lightning by simply erecting on their highest parts a pointed conductor, the other end of which should be well buried in moist earth, and thus the electricity of the atmosphere would be silently and harmlessly dispersed. Does it not appear strange that so sound a principle, so easy in application and so universally beneficial in practice, should, after all that has been written and said on the subject for the last 130 years, be still so imperfectly understood by the general public as to justify the Council of the Meteorological Society in forming a committee "to consider the possibility of formulating the existing knowledge on the subject of the protection of property from damage by electricity and the advisability of preparing and issuing a general code of rules for the erection of lightning conductors?" A committee was formed of gentlemen well qualified for such work and the result of their labours was published in the early part of last year. The report is not so clear on several points as could be, desired, and it is to be regretted that the committee thought it advisable to append to their report so much useless matter, which had they sifted and only formulated that which was important to the subject would have proved more intelligible to the general public, for whose instruction, I presume, it was intended. That the simple requirements for an efficient conductor are not sufficiently understood by all persons who style themselves "electrical engineers" impressed itself strongly upon my mind through a circumstance which lately occurred within my own experience. I was informed that an "electrical engineer" who had been overhauling old or erecting new conductors to shafts in the immediate neighbourhood had, after pointing out that the conductor on a particular shaft had not the points sufficiently high above the brick-work, and that the rod, not being insulated from the chimney, was but of little if any use, made a reasonable offer to replace it by one erected on the most scientific principles. On discussing the question with him, I found that the only reason he could give in justification of the correctness of his criticism was that "it was the custom to so erect them in his part of the country." As the conductor in question had been doing duty for thirty years I thought perhaps it would be at least prudent to have a new one on "pure scientific principles," but I declined to have it insulated, and arranged for the bottom end to be attached to a sheet of copper immersed in a canal adjoining the premises. This he considered quite unnecessary, "for a wooden tank placed at the base of the stack filled with water and the end of the conductor placed in it would be more safe and certainly less costly." The work was, however, done as I desired, and, as far as I know, is doing its duty; but I noticed that soon after its erection the top assumed a horizontal position from the force of the first strong wind. Fortunately for us electrical storms are not so frequent or so severe in this as in other countries, and that no doubt is the reason for the great indifference to and ignorance of the subject. But still, lightning has done harm in town and country, therefore our object should be to provide means by which the current can be carried off without doing any injury. The fact that there is no part of a lightning conductor when charged that will not give lateral sparks to other conducting bodies in its immediate vicinity should not be lost sight of, and that being so, how essential it is, especially at the present time when iron performs such an important part in buildings in the form of girders and roofs, that the whole should be connected to one efficient conductor. Should electric lighting make that progress which I believe it will, there can be no doubt but that responsible and qualified persons will have to be appointed to control the arrangement of at least outdoor conductors, and then perhaps it may be found desirable to place the erection and supervision of lightning conductors in charge of the same persons.

(*To be continued.*)

NOTES.

Explanatory.—Owing to the unusual number of reports of companies, meetings, &c., which have taken place this week, we find it necessary to leave over several important articles, letters, &c. We do not doubt, however, that our readers both professional and general will take considerable interest in the perusal of the business matters of the companies whose transactions are reported in our columns.

Electric Lighting.—Mr. R. S. King, of West Street, St. Philip's, Bristol, has during the past five weeks made some interesting and novel experiments on his premises with the electric light, with very satisfactory results. The shop and warehouse have been illuminated in the evenings with about forty-five Swan lights, in different parts of the building, including the inhabited portion. A Siemens machine is used for generating the current. The use of the electric light has been found by Mr. King to cost about the same as gas, with, however, a much better light; and in consequence of the satisfactory and successful results of the experiment he has decided to continue the light. The switches and fittings were supplied by Mr. Kear, of Redcross Street.

We learn that Callender's patent vulcanised bitumen core has been laid down on the Marquis of Salisbury's estate, Hatfield, since August last, for conveying the current employed in electric lighting. It will be remembered that a man was killed last year by coming in contact with a naked wire forming part of the noble Marquis's installation. Callender's conductors have given such satisfaction that these uncovered wires (solid No. 6 B.W.G.) have been taken down, and are now being insulated with the vulcanised bitumen.

The Streets Committee of the Commission of Sewers, on the invitation of Mr. Shuter, C.C., with Mr. Stoneham, C.C., visited the works of the Telegraph Construction and Maintenance Company at Greenwich, on Wednesday week, and were met by Mr. Willoughby Smith, the electrician. The works are open day and night for the purpose of making the Red Sea Cable, and were wholly lighted with the Swan incandescent light, the private rooms being lighted in a similar way. The feature of the exhibition was the gigantic dynamo-electric machine of Mr. Gordon, which was fully described in our columns for October 28th, 1882. It was pointed out that it would maintain 5,000 lights in a circuit of a square mile, and an ingenious apparatus worked by a single workman regulated the whole system, so that the current could be decreased at will when all the lamps were not in use. The Committee afterwards inspected a large map of Nottingham, which town, we understand, the company intends to light on Gordon's system.

At a meeting of the St. Olave's Board of Works, held last week, Mr. Lafour moved—"That this board support the application of Mr. St. George Lane-Fox to the Board of Trade for a licence, and that it be referred to the board to arrange the terms of the contract, and report to the board." Mr. Cox submitted an amendment, "That in the present state of the electric light it is not right for this board to take any active steps in support of any application for a licence;" and on a division the amendment was carried by 11 to 4.

A special meeting of the Lambeth Vestry, on Thursday week, unanimously resolved to apply for a licence, and to oppose the Provisional Order of the Metropolitan (Brush) Electric Light Company.

The St. Saviour's Board of Works, on the contrary, agreed to take no action with regard to the same company's Provisional Order.

The ballet at the Princess's Theatre, Manchester, in which there are twenty-six ladies, has now been for the past month lit up with the small Swan lamp. Each lady carries a lamp in a small flower placed on her head, and at her side a small battery, the average weight of which is 1½ lb. The arrangements have been carried out by Mr. H. Bury, of Manchester.

The electric light is making headway in Cardiff, and this is no doubt due to the enterprise of the Great Western Electric Lighting and Power Company, which has established works in Working Street, and placed therein two engines capable of indicating 60 H. P. each, and being sufficient to supply 120 large arc lamps of 2,000 candle-power. Among the first to avail themselves of the advantages offered by the company were the proprietors of the *South Wales Daily News*, and now the composing-room, the jobbing offices, the bookbinding-room, and the establishment generally is illuminated with the powerful Brush arc light, which is found as much an improvement on gas as gas was to the old-fashioned dip candle. The company, which is the sole agent for the Brush light in South Wales, has just lighted up the Commercial Dry Dock, for the Tyneside Engine Works, with sixteen Brush arc lamps, each of 2,000 candle-power, run off a No. 7 Brush machine and driven by a Marshall portable engine. The work was carried out under the personal superintendence of Mr. Philip Jolin, Member of the Institute of Mechanical Engineers and managing electrician to the company.

The first permanent installation of electric lighting in Bolton took place on Monday, the 22nd inst., at Messrs. Haslam's cotton mills. The dynamo is one of Siemens' (shunt wound), and the lamps are Swan's 20 C. P. The installation has been carried out by Mr. William Banks, and is so far very satisfactory.

Mr. Octavius Coope recently published a long letter in the *Times* concerning the lighting of his mansion, Berechurch Hall, near Colchester, by means of 200 Swan incandescence electric lamps and 4 Bürgin dynamo-electric machines. Mr. Sellon also, of secondary battery renown, follows the example of Mr. Coope, and each comes to the conclusion that their respective residences are illuminated more cheaply by means of electricity than by using gas. Another correspondent points out, however, that although the above result may be true in respect to large mansions, electricity must be supplied at a much cheaper rate than £1,500 for a private installation before it can come into general use, as in most of the villa residences around London 30 lamps would be found amply sufficient for all purposes.

The fourth general meeting of the twenty-sixth session of the Institution of Engineers and Shipbuilders in Scotland was held on Tuesday last in Glasgow. Principal Jamieson read an interesting paper on "Electric Lighting for Large Spaces and Workshops." With regard to the power required in driving dynamos, the most suitable and the most popular, he said, was the steam-engine. Gas-engines were becoming more popular by the use of a fly-wheel on the dynamo shaft with a long slack pulley to counteract the somewhat irregular motion of the engine. Water-power had been as yet but sparingly used, but there could not be much doubt that when mill-owners whose works were supplied with plenty of water-power began to realise the advantage of this form of artificial lighting, water-power would be greatly taken advantage of, and as it could be very easily manipulated it would be found as efficient as the steam-engine. Speaking of the relative cost of the electric light and gas, the author of the paper said there could be no doubt that the introduction of the electric light had greatly stirred up inventors, and gas managers were now making more of their gas than formerly. But he himself had made experiments with the Siemens burner—the most perfect system of burning gas yet discovered—and he found that, including the price of the gas, the cost of erecting the lamp, and the wages of the workman who attended to it, the cost per hour might be estimated at 3·83d. He had been informed by the manager of the Brush Electric Light Company (of Scotland, we presume) that that company was prepared to supply light to any person or combination of persons using 40 lamps at 3d. an hour; so it appeared that the electric light could be produced more economically than gas. The discussion was adjourned.

The Manchester and District Edison Electric Light Company has just fitted up the Theatre Royal in that city with 460 of Edison's incandescence lamps. The work has been done under the personal direction of Mr. R. Ruddle and Mr. A. E. Greener. Two hundred of the incandescence lamps, each with a stated illuminating power equal to sixteen candles, take the place of the 225 gas jets in the sunlight, and the remainder of the lamps, all of the same power, are distributed in other parts of the house. In the ceiling of the dress circle promenade there are five electroliers, each carrying a lustre of lights. The lamps are said to give a fine light and illuminate the theatre in a way entirely beyond comparison with gas as formerly used. We understand it is contemplated to adopt the same system of lighting at the Prince's Theatre in the course of this year.

In Mr. Justice Chitty's Court, in the Chancery Division of the High Court of Justice, on Thursday, the petition for the winding-up of the Devon and Cornwall Electric Light and Power Company (Limited) was on the paper to be heard. On Monday, in the same case, Mr. Justice Chitty said that the mere statement by counsel that the petition was opposed was not sufficient to take it out of the unopposed list. On Wednesday the case was taken before the Appeal Court, when the Master of the Rolls said, with all respect to Mr. Justice Chitty, that that was not so; that a counsel saying, when a petition was called, it was opposed, did take it out of the unopposed list. This having been mentioned to Mr. Justice Chitty on Thursday, his lordship declined to hear the petition further, stating that it must stand over, and he would see the Master of the Rolls on the matter. His lordship however granted an order for a special examiner.

An extraordinary general meeting of the shareholders of the Dublin Electric Light Company (Limited) was held at the offices of the company at 12 o'clock on Monday. The special resolution adopted at the meeting of the 4th inst., "That the company be wound-up voluntarily," was unanimously confirmed.

The Clerkenwell Vestry held a special meeting last week, and, after considerable discussion on the subject, by 26 to 1 the Maxim-Weston Company was granted powers to run "temporary overhead wires during the pleasure of the vestry," for the purpose of carrying out the Pentonville-hill experiment. Consent was also given the company to supply any tradesman requiring the light. The consideration of the applications by other electric lighting companies was referred back to the committee.

The Lizard-Bilbao Cable.—Communication with Spain over this cable is again interrupted. The s.s. *International*, Captain R. Draper, has left to repair the cable. Mr. H. Benest is in charge of the work, assisted by Messrs. J. Rymer Jones and J. Rippon. We wish Mr. Benest the same success he had when last repairing this cable.

Interruption of Post-office Cables.—Owing to the interruption of the Dartmouth-Guernsey and the Guernsey-Alderney cables, as well as of the Cantyre (Scotland) Island of Islay cable, the Post-office authorities have chartered the s.s. *Dacia*, belonging to the Silvertown Telegraph Works, for the repairs of these cables. We hear that the *Dacia* will leave very shortly to repair first of all the main Channel cable.

Duplicating the China Cables.—The s.s. *Scotia* left the Thames last week loaded with cable, made by the Telegraph Construction and Maintenance Company for the Great Northern Telegraph Company, and which will be laid along the coasts of China, so as to duplicate the present system of cables. Although the two starting-points will be as before, we understand the intermediate points of landing the new cables will not be the same as those of the present system, as shown by the following statement :—*Present system.*—1, Hongkong to Amoy ; 2, Amoy to Gutzlaff ; 3, Gutzlaff to Woosung, near Shanghai ; 4, Gutzlaff to Nagasaki (Japan) ; 5, Nagasaki to Wladiwostock (Russian Tartary). *Intended system.*—1, Hongkong to Fu-Chau-Fu ; 2, Fu-Chau-Fu to Tong-sha Island of the Pih Keun or White Dog Islands ; 3, Fu-Chau-Fu to the Saddles Islands ; 4, Saddles Islands to Shanghai ; 5, Saddles Islands to the Island Tsu Sima, in the Strait of Korea ; 6, Tsu Sima to Posiette Bay for Wladiwostock (Russian Tartary).

Shetland Telegraphic Communication Interrupted.—During the heavy gales of Friday and Saturday last the telegraphic land line in the island of Shapinshay was blown down, causing a complete stoppage of traffic between the mainland and Shetland.

Telegraphs in France.—The French revenue returns for 1882 show the receipts from posts and telegraphs to have reached the amount of 153,000,000 francs, or an increase of 4,000,000 francs, and this notwithstanding a loss of 1,000,000 francs on the inland telegraph service.

Automatic Telegraphy.—The French Minister of Postal Telegraphy in France, says *Nature*, has established at the central office a special course of lectures on Wheatstone's automatic apparatus, to which sixteen competent operators, from different parts of the country, have been admitted. The course of lectures and experiments has lasted two months. The pupils are now passing an examination, and a special certificate will be issued to the successful candidates, which will greatly help them in their future promotion in the postal telegraphic service.

The New American Cable.—The *Standard's* New York correspondent, telegraphing under date January 12th, says : The Western Union will permit the Direct and French Cable Companies to open an independent office for the receipt of messages. The concession is too late to prevent the new cable being laid, despite the rumour of the abandonment of the project. An attempt was made to create a panic in stocks by the intentional delivery to the wrong parties of an order bearing the forged signature of Jay-Gould to sell a large number of shares of certain railways.

Electrical Progress.—It has been remarked that we are only on the threshold of discoveries in electricity. It is not, perhaps, an original remark, since it has been made by several millions of people at bi-weekly intervals during the last three years, but it is evidently entirely true. Since the invention of the telephone there has been a constant succession of new inventions, and each new invention speedily leads to others.

The electric light was originally designed for illuminating purposes. While it has fully answered its original purpose, it has proved to be of immense service in wholly unexpected directions—that is to say, the same electric current which furnishes light can be made to do a large amount of other and exceedingly useful work.

The discovery that the wires of the electric light form the most efficient of all rat-traps was made accidentally. The electric light suddenly went out one night in a private house, and on examination it was found that a rat had touched the two wires in the cellar and thus closed a circuit with his unsuspecting paws. The rat was killed instantaneously by the electric current, and his body remained, with one paw uplifted, in precisely the attitude in which death overtook the unfortunate animal.

The hint thus furnished has been used by Prof. Smith, and is the basis of his Electric Rat and Mouse Annihilator. Instead of an elaborate trap, which rats and mice of any intelligence refuse to enter, the professor uses wires. On all sides of the cellar, and at a height of two inches from the ground, is placed a small wooden trough sprinkled with cheese, while on each side of the trough run the electric wires which furnish light to the rest of the house. The mice and rats are naturally attracted by the cheese, and in endeavouring to reach it touch the two wires and are instantly killed. This admirable invention will clear a house of rats and mice in a single night, and in some places where it has been tried no less than three gross of assorted rodents have been found the next morning standing in hungry attitudes over the fatal trough. It is obvious that this admirable invention will entirely supersede the old-fashioned traps, and its universal adoption will lead to the total extermination of rats and mice.

Closely connected with the electric light is Prof. Brown's Infallible Burglar Discourager, an invention which owes its origin to the fact that the strong current of electricity used in connection with certain systems of electric lighting has on several occasions killed incautious men. Prof. Brown surrounds every window and door with electric wires. In the daytime these wires are disconnected with the battery, so that they can be touched with impunity, but at night, after the house is carefully locked up, the head of the family turns on the electricity. The burglar who attempts to enter the house by surreptitiously opening a door or window, does not disturb the family by ringing electric bells, but he simply receives a severe shock of electricity the moment he touches the wires. The shock kills him as suddenly as if he were an incautious rat, and in the morning the family find him in the attitude in which he died, rigid, lifelike in appearance, and effectually discouraged. The removal of his body is, of course, the work of the police, and it is thought quite possible that if the burglar carries his name and address in his pocket, the police will in some cases be able to obtain a clue to his identity.

Prof. Robinson, in his Electric Cat Specific, has made yet another application of the electric light wires. As is well known, the urban cat inhabits the back fences of city lots. Very few cats are found on the roofs of city houses, doubtless for the reason that the roofs are flat, and hence are destitute of a ridge-pole on which the cat can sit and obtain an uninterrupted view of the neighbourhood. Sitting on the edge of the fence, the cat can watch the approach of enemies with or without bootjacks, and can take proper measures for avoiding them. So strictly confined are city cats to back fences, that could we capture every one who mounts a fence, we should soon render the city cat as extinct as the dodo.

The Electric Cat Specific is a system of electric wires running along the tops of back fences. Like the wires of the Burglar Discourager, they are harmless in the daytime, when the current is cut off, but are eminently deadly at night when the current is turned on. The midnight cat mounts the back fence only to be stricken with instantaneous death. She utters no moan, and her attitude is so natural that it creates no suspicion in the minds of other cats. In fact, the more thickly the top of any given back fence becomes crowded with dead cats, the more anxious other cats become to join the crowd, and take part in what they imagine to be a great feline gala concert.

The Electric Cat Specific was recently tried in connection with the back fence running through the interior of the block bounded by Fourth Avenue, Madison Avenue, Twenty-third and Twenty-second Streets. The current was turned on at eleven o'clock at night, and at seven the next morning 231 cats were found dead on the top of the fence, while some more had fallen to the ground. The demonstrative efficiency of Prof. Robinson's great invention will insure its rapid and general adoption, and thus electricity will once more have conferred a signal blessing upon the human race.—The *New York Times*, January 5th, 1883.

Presentation.—Mr. James A. Scrymser, of New York, was on New Year's Day presented with a handsome silver service by Messrs. I. Pierpont Morgan, Charles Lanier, William G. Hamilton, Alfred Pell, and James K. Gracie, directors of the Mexican Telegraph Company, and of the Central and South American Telegraph Company, in recognition of his indefatigable zeal and ability in bringing to a successful issue the establishment and organisation of the telegraph systems of these two companies, which extend from Galveston, Texas, to Lima, Peru, and comprising over 4,000 nautical miles of submarine telegraph cable and 300 statute miles of land line.

Lectures on Electricity.—The courteous Secretary of the Institution of Civil Engineers informs us that arrangements have been made with eminent men of science for a course of six lectures on the application of electricity, to take place in the Institution on Thursday evenings at 8 o'clock, in the following order:—February 15th, "The Progress of Telegraphy," by Mr. W. H. Preece, F.R.S., M. Inst. C.E. March 1st, "Telephones," by Sir Frederick Bramwell, F.R.S., V.P. Inst. C.E. March 15th, "The Electrical Transmission and Storage of Power," by Dr. C. William Siemens, F.R.S., M. Inst. C.E. April 5th, "Some Points in Electric Lighting," by Dr. J. Hopkinson, F.R.S., M. Inst. C.E. April 19th, "Electricity applied to Explosive Purposes," by Professor F. A. Abel, C.B., F.R.S., Hon. M. Inst. C.E. May 3rd, "Electrical Units of Measurement," by Sir W. Thomson, F.R.S., M. Inst. C.E. We are heartily pleased with the enterprise of the Council of the above Institute, and we believe that these lectures will be of great service to professional men. But why is it that lectures of a similar character cannot be organised by the Society of Telegraph Engineers and of Electricians?

The Phosphor Bronze Company.—Mr. Lazare Weiller, of Angoulême, the inventor of silicium bronze, has joined the board of directors of this company.

Opening of London Offices.—We are informed that Messrs. W. T. Glover & Co., the well-known electrical wire and cable manufacturers, have opened offices at 28, Budge Row, Cannon Street, London, E.C., under the charge of Mr. A. L. Craig.

Progress.—A little more than a hundred years ago the Hawaiians were savages and cannibals. Now the planter cuts his cane at night with the aid of the electric light, and transacts his business during the day by telephone. Throughout the island and the plantations the use of the telephone is general; in the city of Honolulu there are upwards of 300 telephone lines.

Premium for a Perfect Safety Mining Lamp.—In the last volume of the ELECTRICAL REVIEW we announced that a premium of £500 had been offered by Mr. Ellis Lever, of Culcheth Hall, Bowdon, for a perfect safety mining lamp. The money has now been handed over to the Central Board of the Miners' National Union, and will be paid to any person, either within or without the United Kingdom, who shall invent a portable electric or other safety lamp to be used in mines. The following are the conditions:—1. The £500 to be invested in the names of three trustees, one of whom shall be Mr. Thomas Burt, M.P., the two others to be chosen by the Central Board of the Miners' National Union. 2. The lamp to be a perfectly portable electric or other lamp, which the working miner can conveniently carry from place to place in the mine, and which will not under any circumstance whatever cause an explosion of gas. 3. The efficiency of the lamps put in for competition to be submitted for examination by five gentlemen, composed as follows:—Three scientists, to be named hereafter, one to be selected by Mr. Lever, one by the Council of the Royal Society, and one by the Council of the Society of Arts; one person representing the mining engineers, chosen by themselves, and one person representing the workmen, chosen by the Central Board of the Miners' National Union. 4. The adjudicators to meet in London after the allowed time has elapsed. 5. The offer to remain open until the 31st December, 1883. 6. If a lamp meeting the requirements given above has not been invented the £500 to revert to Mr. Lever.

A New Application of Electricity to Tramways.—From America comes the announcement that Mr. E. A. Sperry has invented a new method of applying electricity as a motive-power to street tramways, and his system is shortly to be tested on one of the lines in Chicago. Mr. Sperry claims that his invention will both propel and light the cars.

United Telephone Company v. Harrison, Cox-Walker & Co.—The case of the United Telephone Company against Messrs. Harrison, Cox-Walker & Co., of Darlington, came before the Master of the Rolls and Lords Justices Lindley and Bowen in the Court of Appeal of the High Court of Justice on Tuesday. The plaintiff company are, as is well known by most of our readers, assignees of a patent for a telephonic transmitter, invented by Mr. Edison, and of a patent for a receiver, invented by Professor Graham Bell. The defendants are manufacturers of telephones, with a receiver known as the Cox-Walker receiver. The plaintiffs claimed an injunction to restrain the infringement of both their patents. Mr. Justice Fry, in April last, refused the injunction as to the Edison patent, on the ground that the patent was invalid, and that it claimed inventions not properly set out in the original specifications, but granted an injunction as to the Graham Bell receiver. The defendants now appealed. Mr. Hemming, Q.C. (with whom was Mr. Goode), opened the case for the appellants. Having stated that the appeal was by the defendants in the action, and against a portion only of the decision of the court below, he explained that the point was whether or not his clients had infringed Bell's patent; and that he maintained depended upon the construction put upon the specification filed by Professor Bell. According to one construction, they had not infringed at all, and according to another they had, but whichever of the two constructions of which it was capable was put upon the specification was a matter of indifference to the defendants, because the construction which would make them infringe would make the patent hopelessly bad on the ground of anticipation. Inside the Bell receiver was a permanent magnet with a coil of wire round a soft iron prolongation of the magnet, and above that was a disc of metal. The defendants' was an instrument similar in some respects but different from it mainly in this, that instead of having a permanent magnet, it had a horse-shoe electro-magnet; and what they hoped to establish was that the solitary invention for which Prof. Bell could claim patent rights in 1876 in respect of receivers was the substitution of a permanent magnet for that electro-magnet, all the remainder of the receiver being at the time old. At the rising of the court the learned counsel had not concluded his arguments, and the further hearing of the case was adjourned till yesterday. We must therefore leave the fuller mention of the case until next week. Mr. Aston, Q.C., Mr. Webster, Q.C., and Mr. Moulton appeared for the plaintiff company.

The London and Globe Telephone Company v. the United Telephone Company.—In the Chancery Division of the High Court of Justice on Thursday, before Mr. Justice Fry, Mr. Hemming, Q.C., said that in the cause of the London and Globe Telephone Company against the United Telephone Company, he had to move that the directors and secretary of the latter be committed to prison for their contempt of court, "in issuing, publishing, and advertising" a notice or circular, dated 11th January, 1883, signed by the secretary of the company, and advertised in the *Bradford Observer* of the 16th, 18th, and 20th January, and also in the *Blackburn Standard*.

Mr. Cozens Hardy, Q.C. (who appeared for the United Telephone Company): I must ask this motion to stand over. We only got notice of the affidavits yesterday afternoon.

Mr. Hemming: That is reasonable enough if my friend will stop the advertisement in the meantime. It is usual, I think, to abstain from advertising during a period in which indulgence is asked for.

Mr. Justice Fry: If it is not an offence, I cannot stop it, but I daresay Mr. Cozens Hardy will advise his clients wisely in the matter. If they persist in advertising and it turns out to be contempt of court, then probably I shall deal more harshly with them than I should otherwise have done. It is difficult to open a motion for committal when the affidavits have only been filed on the previous afternoon.

Mr. Hemming: I do not desire to open it, but I think matters should be kept in *statu quo*.

Mr. Justice Fry: The *statu quo* is against you, as they are advertising.

Mr. Hemming: We have suffered from the publication of the advertisement, and it will be only asserting our rights if I open the motion. My friend would not want to answer our affidavits if we had not a good case.

Mr. Justice Fry: It is useless to go on with the matter. How can Mr. Cozens Hardy deal with it until he has seen your affidavits?

Mr. Hemming said, after his lordship's intimation that he should perhaps deal more harshly with the defendants if the advertisement was continued, and it turned out to be contempt of court, he would agree that the motion should stand over till next week.

United Telephone Company v. Dale.—On Thursday, in the Chancery Division of the High Court of Justice, before Mr. Justice Fry, Mr. Cozens Hardy, Q.C., stated that he had a motion to make in the case of the United Telephone Company *v.* Dale, but that, with his lordship's permission, he would ask that it stand over for a week, and this was agreed to.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Eastern Electric Light and Power Company (Limited).—The second return of this company, made up to the 14th November, was filed on the 17th inst. The nominal capital is £250,000, in £5 shares. 29,000 shares have been taken up, and upon 20,900 of these £4 per share has been called up and the full amount upon the remaining 8,100. The calls paid up to the date of making up amount to £123,045, leaving £1,055 unpaid. Registered office, Winchester House, 53A, Old Broad Street.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1882.

2519. "Air-exhausting apparatus to be used in preparing incandescent electric lamps." W. H. AKESTER. Dated May 27. 6d. This invention relates to what are known as incandescent electric lamps in which the light is produced by the passage of an electric current through a strip of carbon in a glass bulb or vessel in which there is a vacuum, the object of the invention being to improve the arrangements and apparatus by which the vacuum is obtained. In carrying out the invention, mercury is employed, and as it enters the apparatus connected with the bulbs at a high level, and is withdrawn from it at a low level, a pump of special construction is employed to raise it from the low level back again to the high level.

2532. "Treating certain materials to render them dielectrical." E. W. BECKINGSALE. Dated May 27. 2d. Relates to a novel method of rendering non-conducting materials which are porous, such as bricks, stone, tiles, pipes, stoneware, porcelain biscuit, cement, slate, lime, plaster of Paris, china clay, sulphate of baryta, more perfectly dielectric, for the purpose of better insulating any conductors or generators of electricity. This is effected by injecting into their pores or substance, hydrocarbons, such as petroleum oil or some of its preparations, such as paraffin oil or wax, either alone or in combination with tar, resin, or shellac, or a mixture of some of them, by which more consistency will be obtained, and the volatile portions of the hydrocarbons absorbed. (*Provisional only.*)

2560. "Electric lamps." S. HALLETT. Dated May 31. 4d. This invention relates to certain improvements upon the subject matter of Letters Patent bearing date 17th September, 1881, No. 4017, and to electrodes for electric lamps generally, and primarily to that class of electric lamps in which light is produced by the incandescence, on the passing of an electric current, of a conductor or bridge of carbon enclosed in a glass vessel from which the air has been exhausted, and the invention consists chiefly of improvements in the carbon conductor itself, and in the mode of attaching it to its connections, and also to the preparation of carbons for electric lamps, whether the arc or incandescent description, and an improvement in the sockets of electric lamps and in the method of attaching the lamp socket to the bracket or holder, and an improvement in the contact breaker of electric lamps.

2565. "Dynamo-electric machines." A. J. JARMAN. Dated May 31. 6d. The improvements consist in a new form of armature, comprising an outer thin sheet iron cylinder, enclosing an inner divided and separate cylinder of thin sheet iron, an annular air space existing between the inner and outer cylinders. The outer cylinder is continuous, the inner one is divided at its centre, or at any convenient distance from the ends so as to form practically two short cylinders. By dividing the inner cylinder it is quite impossible for currents induced by the wire surrounding the outer and inner cylinders to circulate in the metal. Stays or ribs of wrought iron are riveted radially to the external face of the outer cylinder and are made wide enough to allow several tubes of copper, silver, or other good heat conducting metal to be inserted along their length, passing from the periphery of the ribs through them to the annular space—between the two cylinders, the object of the tubes being to carry off any heat, which may be generated by freely ventilating the cylinders, and by their conduction assisting to that end.

2571. "Making the insulating bodies of electric-light conducting wires non-inflammable." W. A. PHILLIPS and S. E. PHILLIPS. Dated May 31. 4d. Relates first to the employment of tungstate of soda or other chemical acids, salts, or oxides capable of rendering pitch, india-rubber, gutta-percha, and other bodies non-inflammable, either mixed directly or otherwise, to insulating or mechanical coverings of electrical coverings. Secondly, to a special method of making an oily solution of the said substance or substances, which solution may be mixed with any compound material, or varnish used to cover wires.

2573. "Dynamo-electric machine." S. HALLETT. Dated May 31. 6d. Relates to the construction of a new or improved dynamo-electric machine, and to certain improvements in such machines, the object being to obtain by improved arrangement and construction of parts currents of varied intensity from one and the same machine, thus enabling persons engaged in the deposition of metals to work two or more vats containing different solutions by the same machine, and at the same time and whilst carrying on the deposition of various metals to light their factories from a current obtained from the same machine, and further, by simplifying the parts, to lessen the cost of manufacturing machines, and also by an improved method of coiling, winding, covering, and making up the magnets, to obtain a larger proportion of current per horse power expended than can be otherwise obtained.

2578. "Telephonic instruments." SILVANUS P. THOMPSON. Dated May 31. 6d. This invention relates to telephonic instruments, and chiefly to improvements in receivers of a well-known form or type, invented by Phillip Reis. In this instrument, which is now commonly known as the Reis receiver, the telephonic currents are received in a coil of wire surrounding a needle or rod of iron or steel, mounted upon a suitable sounding box of wood. In the said instrument the variations in the strength of the current produce variations in the degree of magnetisation of the needle, which, in consequence of the molecular changes set up by these variations in its magnetisation, emits sounds. The final result of such molecular changes, is in general, to produce either an expansion or a contraction of the said rod, bar or needle. It is known, for instance, that the effect of increasing the degree of magnetisation of a rod of iron, steel, or cobalt, is to make it expand in the direction of its magnetisation, and that an increase in the degree of magnetisation of a rod of nickel causes it to contract in the direction of its magnetisation. In this well-known needle instrument of Reis the sounds emitted are not loud, partly because the mass of magnetic metal is too great to permit the required changes in its degree of magnetisation to be rapidly effected, and partly because the acoustic arrangement of the parts is defective and inconvenient. The aforesaid needle is not so mounted as to affect the sounding box in the most direct manner, and the shape of the instrument prevents its being so conveniently applied as the modern forms of telephone receiver to the ear. The improved instruments are all based upon the same principle of utilising the expansion and contraction arising from the molecular changes set up by the varying degree of magnetisation due to the telephonic currents, and the improvements hereinafter set forth relate to various methods of obviating or avoiding the defects of the said Reis instrument, whilst preserving and developing its fundamental principle. Fig. 1 represents a central longitudinal section of an instrument constructed according to the invention. In the form of instrument shown in fig. 1, a thin rod, or piece of very thin wire, W, of iron, steel, nickel, cobalt or other magnetic material, is fixed by one end to the centre of a tympanum, T, of mica, horn, ebonite, sheet metal, or other appropriate substance. Its other end is fixed to an adjusting

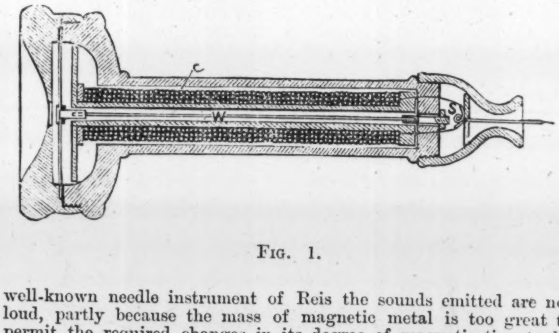

FIG. 1.

screw, or pin, s, by means of which the said thin rod or wire can be strained and retained at any desired degree of tension. In some instances the inventor uses flat ribbons or strips of thin iron, steel, nickel, cobalt, or other magnetisable metal, in place of the thin rod or wire. The said central rod, wire, ribbon, or strip, is surrounded by a coil or coils, c, of covered copper wire, which is wound upon a glass tube, or other suitable tube or bobbin, the central rod, wire, ribbon, or strip being left free to vibrate, undisturbed or unimpeded by contact with the coil or bobbin. The combined tympanum, wire or ribbon, and adjusting screw or pin, are enclosed in a case of convenient form, having an ear-piece. The general action of this instrument is as follows, that is to say:—If the current received in the coils, c, through the line from the transmitter increases in strength it will change the molecular condition of the central rod, wire, ribbon, or strip, causing it to elongate slightly if it be of iron, steel or cobalt, and causing it, if it be of nickel, to contract slightly. A decrease in the strength of the current will be followed by a partial demagnetisation of the central rod, wire, ribbon, or strip, producing an inverse movement. Hence, as one end of the said central rod, wire, ribbon, or strip is tightly screwed up to the case of the instrument, the varying or fluctuating currents entering the same will cause corresponding vibrations of the tympanum. This telephonic receiver, when connected up with any suitable transmitter, reproduces sounds much more loudly than the original Reis-needle instrument hereinbefore referred to; and its articulation, especially of the sibilants, and of some other consonants, is much clearer and more distinct than that of the common magneto-telephonic receivers. Fig. 2 shows a further modification of the instrument. In order the more effectively to magnetise the wire, strip or ribbon, *w*, its ends are embedded in two lumps or masses, M, of magnetic metal, such as soft iron. In this form of the instrument the anterior end of the wire or strip is attached to the tympanum, the posterior end is screwed to the closed end of an iron tube, J, which serves as a case for the instrument, and encloses the central wire or strip and the coils, C C. The inventor further modifies the arrangement of the wire, strip, or ribbon in his instrument as follows:—The wire or strip is bent into the form of a cork screw, or helix, as shown in fig. 3, or a helix is formed by taking a tube of iron or steel of suitable diameter, and cutting it spirally from end to end, the separate turns of the spiral being slightly separated by means of the adjusting screw. The inventor sometimes modifies the construction of the improved instrument in the manner indicated in fig. 4, that is to say, he uses a double coil, composed partly of a few turns of thick wire, and partly of many turns of thin wire. This coil may be either in one continuous circuit with the line, or may be separated into two distinct circuits, the thick wire being connected with a local battery at B, or at B^1, and the thin wire being joined in circuit with the line wire, and through it with the distant transmitting apparatus.

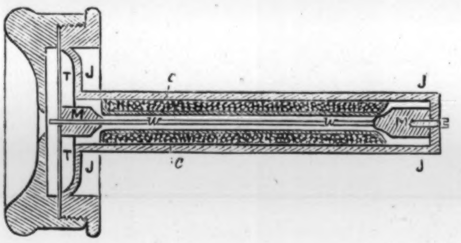

FIG. 2.

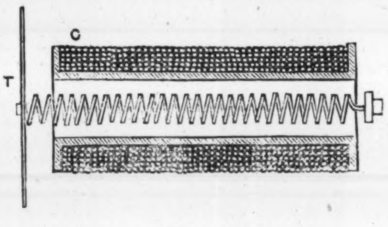

FIG. 3.

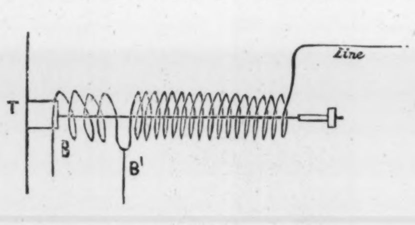

FIG 4.

2595. "Materials for use in secondary electric batteries." W. BOGGETT. Dated June 1. 2d. The object of the invention is by mechanical means to obtain metallic lead in a state of fine division or in very minute particles with a view to its utilisation in the manufacture of electrodes for secondary or storage batteries. The first part of my invention consists in employing a disc of lead of any desired size, say about 6 inches thick by 14 or 16 inches diameter more or less, cast with a centre hole to receive a shaft whereon the disc revolves, and while so doing pressing a suitable tool against its circumference whereby small particles are detached available for the purpose in view. (*Provisional only.*)

2602. "Secondary batteries." Sir C. T. BRIGHT. Dated June 2. 4d. Consists of improvements in secondary batteries or accumulators for the storage of electricity derived from a primary generator, such as dynamo-electrical machines, galvanic batteries, or other sources of electricity. The improvements have for their object the lessening of the weight and space required for a given surface of the elements employed, and augmenting the effective action for receiving, storing, and utilising the charges of electricity; while also simplifying and economising the construction and preparation of the secondary batteries. In carrying out the first part of the improvements, each division or cell of the secondary battery is separated by a porous diaphragm into two parts, which are filled or nearly so by a great number of small spherical granules made of any suitable conductor. Electrical connection is made with two masses of spherical granules in each side of the cell by means of electrodes communicating with them. The inventor finds the ordinary small lead shot, although containing a very little arsenic, to be very suitable as spherical granules, and in using them he employs electrodes made also of lead, and sulphuric acid diluted with water, as the conducting fluid in the cells. The second part of the improvements consists in covering the surfaces of the spheres employed with a coating of dioxide of lead by one of the two following processes. The first process consists in converting the surface of the spheres into a carbonate of lead by exposure to the action of the vapours of acetic acid, and of carbonic acid, treating the coating of carbonate of lead so produced with chlorine gas. The second process consists in converting the surface of the spheres into a protoxide of lead by exposure to heat and the air, and afterwards to chlorine gas. The third part of the improvements consist in mixing dioxide of lead in powder with the granules of lead, and this improvement is applicable to other forms of secondary battery, as where wire, network, or other arrangements of lead surfaces (where small interstices can be filled up) are employed.

2629. "Intensifying fluorescent or phosphorescent electric lighting." R. KENNEDY. Dated June 5. 2d. It is well known that beautiful but faint electric lights can be produced in vacua by discharging currents of high tension electricity between metallic points within a vacuum. It is also known that a discharge of negative electricity in high vacua when made to impinge on the surface of fluorescent or phosphorescent bodies renders these bodies, or rather the surface of these bodies, luminous to a small degree. The currents discharged into the vacuum tubes or bulbs used to show such lights are generally produced by frictional electric machines driven by hand or other power, or Holtz electric machines, or Rhumkorff induction coils. This invention provides means of intensifying and increasing the lights produced by discharging high tension charges of electricity in vacua between two or more metal or carbon or other conducting bodies; these bodies may be pointed wires or balls or flat discs, and are sometimes both partly or altogether coated with various fluorescent substances, or with phosphorescent substances, such as sulphuret of barium or sulphuret of calcium.

CITY NOTES, REPORTS, MEETINGS, &c.

The Western and Brazilian Telegraph Company (Limited).

ON Thursday, at noon, at St. Michael's House, George Yard, Lombard Street, an extraordinary general meeting of the shareholders of the above-named company was held (Sir Henry Drummond Wolff, K.C.B., M.P., chairman of the company, presiding) for the purpose of confirming the following special resolutions passed at the extraordinary general meeting held on the 11th inst.:—"1. That in pursuance of the provisions of 'The Companies Acts, 1867 and 1877,' the sum of £349,550 capital lost, or unrepresented by available assets, be written off the capital account, and that the conditions contained in the Memorandum of Association be modified by reducing the capital from £1,398,200 divided into 69,910 shares of £20 each, to £1,048,650 divided into 69,910 shares of £15 each. 2. The following article shall be substituted for the existing article 40, viz.: 'The board may appoint a managing director, who may be a member of the board, at such remuneration and with such powers and duties as the board shall determine, and may from time to time remove him and appoint another or discontinue the office. The managing director shall not be subject to retirement by rotation.' 3. Also for the purpose of passing the following resolution approved at the last meeting, and of which notice has been given at the company's office: 'That in view of the great services of the board in relation to the late litigation, by which a very large sum of money has been recovered for the company, and the company placed on a sound footing, and as a recognition by the shareholders of the successful result of their labours, the directors be requested to accept 700 of the shares acquired by the company as a part of the settlement, and now held by trustees for the company, to be divided amongst the members of the board as they may determine.'"

Major Wood, the managing director, having read the notice convening the meeting and the minutes of the last meeting,

The Chairman said: Now it is my duty to move the first resolution, and in doing so I may say that the action of the company in this matter has received the general approbation of the company, inasmuch as we have received a larger number of proxies from shareholders than we have ever received from them before. He thought it unnecessary to detain them longer than to move that the first resolution be confirmed.

Major Wood (managing director): I beg to second that.

The resolution was then put and carried.

The second resolution, as to the appointment of a managing director, was then put by the chairman and also carried.

Mr. Pike then rose and remarked that he had on a former occasion done very much what he had to do that day, viz., to propose the third resolution that was on the notice for that day. He thought that the company, having been through very troublesome times, and having now been placed on a sound basis, which was, he considered, due to the energetic efforts made by the directors, their services should be recognised in the substantial manner set forth in the resolution which he would cordially recommend to the meeting and ask them to pass it.

Mr. Henry Sutton seconded the motion. He did not consider it necessary to speak at any length, because the matter was discussed very fully at the previous meeting, and he thought the result was that the majority of the shareholders was in favour of the proposition. When they thought what the result of the board's services amounted to he thought the meeting would vote for the present being made without a dissentient. He had made a little calculation and found that, having regard to the amount of capital that it represented something under 1d. in the £ on that capital—such a recognition he thought they should make; for those services had been extraordinary, and had recovered for the company the sum of £150,000, which he believed it was absolutely impossible to recover, and which would not have been recovered but for the skill displayed by the directors over the business. He thought such an achievement deserved recognition on their part. Although some might think it rather a large sum to vote to directors—(hear, hear)—he thought under the circumstances they should vote it. Some gentlemen spoke last time about £3,000; he thought the difference between £3,000 and £5,000 to them was a mere bagatelle. He thought they should recognise the efforts of the directors, and do it in a princely manner.

Mr. J. R. Race Godfrey said he was only an insignificant shareholder, but he represented persons who had got a good sum of money in the company. He certainly objected to the proposed vote. For five years the shareholders had received nothing, which represented a loss, say of 25 per cent., and in addition to that fact the shares of the company were now at 60 per cent. discount at least; he thought that should be a reason for not doing as was proposed. Under those adverse circumstances even the directors had been paid—and paid for what? For simply doing their duty. Had they done, then, more than their duty? He thought that the gentlemen of the board, for their own honour's sake, would refuse to participate in money which they had not earned.

Mr. Guesdon said he had fought hard to get an explanation of the affairs of that company but had failed. While he was disposed to submit to any liberal offer that might be made to the board, he certainly must say when he first saw the announcement that it was really seriously proposed to give the gentlemen filling the board the large number of 700 shares he was fairly astonished. He was only there to say a word on behalf of the shareholders; he did not wish to detract from the work done by the directors, but he only considered it a part of their duty to take the greatest possible interest in the company. When he saw that large offer was about to be made to the directors, and that the reasonable and just remark of Captain Cotton at the previous meeting were not accepted, he must repeat he did feel a great deal of astonishment. He thought there was some misapprehension in this matter as to what work the directors had really done, of which much had been said. He never heard a word from the circular issued when some of the old board resigned that any of those gentlemen would fail or had failed in their duty so long as they remained in office ("Question"). He received a circular from the secretary concerning the then state of affairs of the company; and he must say he thought, with all respect to the present board, that those former gentlemen really commenced the proceedings with which they were now pretty well acquainted. On the 12th August, 1880, he received another circular, which followed up the same case. When the matter was in the hands of the legal advisers of the company he did not think it was in the power of the directors, however earnest, to multiply the work. The work had certainly been for the greater part transacted by the legal gentlemen, whatever might be due to the directors. He thought the shareholders had been carried away by the sentiment of generosity, which had led them to offer to the directors that which was not fair to be entertained, considering the past and present position of the company. The work of producing the facts upon which the legal proceedings should be taken were in the hands of the manager and secretary, and it was utterly impossible for a new board of directors to become possessed of the necessary facts. He thought much of the good results obtained was due to the hard work and the ability displayed by their legal advisers. All the work for bringing forward the case for argument before the court surely devolved upon the persons he had alluded to. The fees for retaining counsel, the fees for consulting counsel, the fees out of pocket would raise the sum expended over that matter probably to £5,000, for bringing the case to a successful issue. And they really proposed to present the board with 700 shares! He was there as a proprietor—as one of themselves—and he felt, with all respect to the board, that the shareholders were the holders of the company, and the directors the managing partners. If there was a good ground for recognising to such an extent the work the directors had done, he should be glad to aquiesce in the proposition. But how were they to know how much work the board had done? What herculean task had been undertaken by the directors? What evidence had they? He could quite understand that extra work might have fallen upon the secretary, and perhaps a little extra work on the board, but the bulk of all that was done was done by the legal advisers, and they could not have reached that settlement except through their legal advisers. They could not really know what the board had done without seeing the minutes of their meetings. He really must repeat that he thought this offer was an excess of liberality. He might remark, too, that he had some difficulty in finding information concerning their last meeting. He did not think it was reported in many papers.

Major Wood: It was reported in the *Times*.

Mr. Guesdon said he only wished to call the attention of the directors to what he thought a curious thing—viz., that the meeting should be reported in *Money*, which only reached him on the 19th inst. In fact, it was surprising he looked into the paper at all; he had never seen it before, and he almost put it into the waste-paper basket, but he saw that one of the meetings—not that of their own company—was marked. He did not mind, he repeated, a moderate recognition of the services of the directors, but he should protest against such a very liberal offer. It had been impossible for them to make work which did not exist. He took the case upon its merits (hear, hear, and applause). He hoped the proposition would not be carried, and that it should not be said by business men in the City that the shareholders of that company had done such a thing. The best test of the work done in this matter he considered was that of the legal gentlemen.

Sir W. P. Andrew said he was very much gratified at the unanimity displayed by the shareholders at the previous meeting with regard to the work done by the board. To cut the discussion short, he thought the whole matter turned upon the point whether the directors *had* performed exceptional duty or not (cries of "No"). That was really the case. It was admitted that the board *had* performed exceptional duty most advantageously for the interests of this company, and there was only one feeling in the meeting as to their being entitled not only to the approval of the shareholders, but to a substantial acknowledgment for the valuable services rendered to the company. There was a difference of opinion as to the mode of compensation and as to the amount; but the great majority supported the resolution moved by Mr. Pike. He (Sir W. P. Andrew) supported that resolution still, being assured that the meeting would not simply feel that the directors had merely performed their duty, for that would be in direct contradiction to the statement made at a former meeting; for then those who were intimately acquainted with the circumstances satisfied the meeting that those services were not only valuable but exceptional.

Mr. Wells said he had not been long connected with the company, but he had come to the conclusion that the board had performed extraordinary work. He had been listening to the remarks of Mr. Sutton as to the position of the company and the services rendered by the board in this matter. He was of opinion that they never knew a time when there was greater tact needed than when their affairs were in the hands of lawyers. (Hear, hear.) It appeared to him that if ever there were a case of exceptional circumstances it was the case of a company in great embarrassment—having to contend with circumstances of a very complicated and serious character; where, in fact, the judgment of the parties who had got to deal with the business was so important that it, in point of fact, made the whole difference between the recovery of the property and the company being placed on a good and sound footing and its being involved in considerable loss and ruin; and he thought the necessary judgment and management required had been shown by their Board, to whom it was proposed to offer that recognition. He had brought to bear upon the question his own interests. He felt that the duties performed had been exceptional, and he should vote for the recognition about to be put to the meeting.

Major Wood explained that Messrs. Cook and Mendall, of the old board, were in a very invidious position. It was not necessary for him to say why they resigned. Suffice it to say they could not have got that money for the shareholders, and therefore they went away. The gentlemen who succeeded them were untrammeled in every respect, and he was sure it was more satisfactory to them when he told them that if they had not retired their point gained would not, or could not, have been gained. It was a very extraordinary thing that Mr. Guesdon had not received the copy of *Money* sooner; the thing was not done in a corner. The matter was brought before the previous meeting. Mr. Guesdon suggested that the gentlemen who had sent proxies had not read the notice announcing this meeting. The response to the question of the present had been very unanimous; for at the last meeting a person holding ten shares was the only one to object to it.

Mr. Pike said it struck him as peculiar that the man who knew as much about that complicated business as any one had spoken against it. He believed Mr. Guesdon was one of a committee summoned to discuss the state of affairs, but that he shrunk from the magnitude of the undertaking.

Mr. Guesdon, at some length, explained how he was invited to become a party to the investigation of the company's affairs by Dr. Goodsall and how he eventually declined to undertake any liability, when there were cries of "Time" and "Question."

The Chairman: I think the gentleman is entitled to make a personal explanation.

A Shareholder: I am obliged to go; I think we have had enough of this discussion.

Mr. Guesdon concluded by moving, with the chairman's permission, given at the suggestion of a shareholder (Mr. Kendall), an amendment that only 350 shares be presented to the directors.

Mr. Walton seconded the motion.

The Chairman: The Board have made no statement with regard to this matter, and do not mean to do so.

The amendment was then put, and fourteen hands were held up; then the original motion, for which eighteen were shown, and also a number (at the request of Mr. Godfrey) who did not vote at all.

The Chairman: We received 23,000 proxies in favour of the resolution.

The Eastern Telegraph Company (Limited).

THE report of the directors for the half-year ended 30th September last, states that the revenue amounted to £341,152, and the expenditure to £122,610, viz., £69,810 for the ordinary expenses, and £52,801 for repairs and the laying of new cables. After providing £5,496 for income tax, there remains a balance of £213,045, to which has to be added £1,034 bronght from the preceding half-year, making a total available of £214,078. From this balance £22,683 has been paid for interest on debentures, and £20,559 for dividend to 30th September, 1882, on the preference shares, leaving a balance of £170,836. Two interim dividends on the ordinary shares for quarters ended 30th June and 30th September, 1882, and a bonus of 1s. per share for the half-year, have absorbed £114,000, leaving a balance of £56,836 to be carried forward. A contract has been made with the Telegraph Construction Company for the manufacture and laying of a third cable between Suez and Aden, the cost of which, together with the one laid between Alexandria and Port Said, will amount to £320,000, the greater part of which it is proposed to take from the reserve fund.

The twenty-first half-yearly ordinary general meeting of the company was held on Thursday afternoon last at the City Terminus Hotel, the chairman of the company, Mr. John Pender, M.P., presiding.

The Secretary, Mr. George Draper, having read the notice convening the meeting, the minutes of the previous meetings were read and confirmed.

The Chairman said: Gentlemen, I presume you will take the report in your hands as read. I may say that we have taken more than usual care to make the present report as full as possible. We have condensed a large amount of matter into very small compass, but I think that it has placed our position so fairly before you that those who run may read. However, before going more into detail I think it is right that, as usual, I should draw your attention to the ups and downs of our expenditure during the last six months. Our revenue for the six months ending December 31st, 1882, amounted to £341,151, against, for the corresponding period of 1881, £282,834, being an increase of £58,317 for the six months (hear, hear). Analysing these figures, we find a very satisfactory growth of traffic throughout our system, with one or two exceptions. In the first place, the South African Company has earned at the rate of 8 instead of 10 per cent., being a reduction of £3,900 on the corresponding period of 1881. There is, however, an increase of £900 in the Black Sea Telegraph Company. The general traffic, on account of the crisis in Egypt, suffered very materially, but thanks to our arrangements with the Indo-European Company, our receipts did not suffer on the whole. I will merely glance at the differences in our expenditure, because it is well that you should carry them in your mind on this occasion. Last half-year has been rather an eventful one. The ordinary expenditure amounted to £69,809, against, for the corresponding period of 1881, £67,498, being an increase of £2,311. The main cause of this increase is the having opened four new stations, and; likewise extra expenditure owing to increased volume and traffic from Egypt and other places during the war. The repairs to cables cost us £52,801 as against £47,228 for the corresponding half-year, an increase of £5,573. This expenditure will be always more or less fluctuating, as it arises very much from the number of interruptions to our cables. The general expenses in London amounted to £6,670, an increase of £149. The ordinary general expenditure for working expenses at stations was £47,000 in 1881 and £50,387 in 1882. The various items show an increase of £3,522, and a decrease of £553. The other expenses are of a very minor nature, and do not exhibit much difference from 1881. The amount carried forward this year is £56,836, against, for the same period of 1881, £29,504, or an increase of £27,322—(hear, hear)—after paying a bonus of 1s. per share on the ordinary capital, making a return on the half-year at the rate of six per cent. per annum. We have usually paid the bonus at the end of the year, but we are so satisfied with our position that we have thought it as well to give the bonus at the half-year, instead of waiting to the end of the year. When I had the pleasure of addressing you in July last, I referred to the state of our cables. We had at that time two breaks or interruptions in the Red Sea. There was one very important interruption in the Bay of Biscay, which had given a great deal of trouble. We had to hang on for weather to enable us to repair it. I am glad to say that the cable has been repaired after being picked up from 2,700 fathoms of water, showing clearly that after all we have got a property that is worth having—that is, that we can repair cables in the deepest water. It is expensive, I admit, but we can carry it through—find the fault and repair the cable. I then stated, too, that our ships were in a peculiar position. It was our duty to maintain, if possible, telegraphic communication between England and Egypt—important not only on account of the returns for our dividends, but equally important upon broad national grounds. I hold that in the position which we now occupy it is imperative upon us always to consider these wider interests. They involve political and commercial relations, and therefore while benefiting ourselves by maintaining our dividends we must also maintain what I may call our great public interests. We therefore brought one of our ships from the Red Sea, where she was engaged on one of our cables, into the Mediterranean, and that for two reasons. We knew that our land system would likely be interrupted. Thanks to our efforts, the name of the *Chiltern* is now a byword, known to every one for her great services in maintaining telegraphic communication with Europe. We also found our land lines interrupted in Egypt—cut off from Port Said. It is true the Canal was open, but there was no communication except through Turkey. This was a most undesirable thing. The traffic through the Canal was of immense value to ship-owning interests. We thought the time had come when we should endeavour to secure a communication along the Canal. We had negotiations with the Government—prolonged negotiations—but we felt that it was of the greatest possible importance to the public service, and also to the interests of this country, that the head of the Government should be approached while we were endeavouring to maintain our telegraphic communications (hear, hear). But we felt the necessity for prompt action so much that we sent out our ship from the Bay of Biscay to Alexandria with sufficient cable to connect Alexandria with Port Said. We did not do it a day too soon. If we had waited the decision of the Government, we would not have known the consequence to us, and when the order to lay the cable came we were able in a few hours to begin laying the cable, and so communication was kept up between Port Said and Europe, and also between Port Said and India, because we were enabled, after very great trouble and anxiety, to obtain a line between Suez and India. So that we have now, as it were, two strings to our bow (hear, hear). This was done, however, at very considerable expenditure; but as we were masters of the position, we had regard also to the interests of this company. We *have* secured very important interests in favour of this company. I question, indeed, whether the concessions we have got will not give us pretty nearly the full right of working that system which connects England and India, without interference from any other parties. At all events, we should be doing our work very badly if a second party is allowed to come alongside. The last six months have been the most eventful in the company's history, but it is satisfactory to know that, notwithstanding our ups and downs, the interruption to our Indian traffic, we had the largest returns that we ever had at any period of our history. We had spent more money than in the corresponding half-year, but notwithstanding that great expenditure our receipts from telegraphic communication carried on by the Government and by the press between the seat of war and Europe have amply repaid us, and I hope our efforts will be appreciated by the general public as they have been appreciated by the Government. We have received from the Government a letter thanking the board, and those who had taken an active part in it, for their public spirit under very peculiar and very extraordinary circumstances (hear, hear). A company like this cannot stand still; they must be going forward, and in these days of progress at a vary considerable pace. I have alluded to the South African traffic. We find that traffic a very valuable one. That line starts from Aden to Zanzibar. Not only of our Indian, not only of our Colonial, not only of the Chinese, but also of our South African traffic, it is impossible to say of what service that is to our country. We had no hesitation in making arrangements to lay down an additional cable to maintain that line in the efficient state that we think it ought to be maintained in. Also during the six months we have completed a concession which we have from the Turkish Government to lay a cable from Malta to Tripoli, which will be an additional source of revenue to the company. Notwithstanding all these expenses, I believe we have served the general public, we have served the Government, we have given satisfaction to our own constituents, and I think that you will agree that we have been able to put a very fair and satisfactory balance-sheet before you. I feel we have placed our system as a system of telegraphic communication in a position that it would be very difficult to beat (hear, hear). There is scarcely a point anywhere in the world that we have not reached by the aid of our system. We have not gone on by leaps and bounds in our dividend, but we have enormously strengthened and improved the value of your property, and I hope the result will be now that our system is so very near completion that we can look abroad upon it with satisfaction, because we are deriving such benefits from the results of our progressive policy (hear, hear). I think, gentlemen, I have pretty well exhausted my notes. There is a reference in the report to the bonus which we are giving to our staff employed in Egypt. If you will throw your minds back to the last half-yearly meeting, you will remember that there was a very strong expression of sympathy with the young men who were employed there during the war, and in fact a resolution of thanks to them was passed. We felt, however, that in addition to the testimonial of thanks we ought likewise to give them something out of the prosperity to which they had contributed, and having done very well for all parties we thought it would be very wrong to leave them out of our balance-sheet. We have given them, therefore, not a large sum, but one which I believe will satisfy them, and I am sure that it will not in any way interfere with what you are going to receive. We have given them something more than a mere formal resolution, an arrangement which I do not think any one of you will object to, but it will incite them, should such an occasion ever again arise, towards even greater vigour in the future than they have shown in the past. I beg to move that the report submitted be hereby adopted.

The Marquis of Tweeddale seconded the motion.

Mr. Blundell asked if they would be able soon to place the debentures in the market—the £232,000 which was repayable in 1883.

Mr. Wm. Abbott said that he hoped the company would take the earliest opportunity of replacing the money which was spent in their cables from the reserve fund. In the present flourishing condition of the company a large reserve fund was not necessary, but it was desirable always to have such a fund at their back. He could congratulate the board on the admirable selection of stocks which they had made for the investment of their reserves (hear, hear). With reference to the special allowance made to the *employés*, he thought not one shareholder would object. He did not believe in interfering with the relations of the directors to their *employés*, but he thought that an exception might now be made by his suggesting that a similar compliment be paid to the London staff, who had worked hard for the company's interests. He would suggest that the zeal of the London staff might be met with a substantial recognition (hear, hear).

The Chairman said that as to the debentures they were fortunately not in a position to be pressed in any degree; but they were watching the markets and would place them at the very lowest rate. In regard to reserve fund, he entirely concurred in the necessity of having a large and substantial one. He had got an idea that they should add £100,000 a year to it, and they might be assured that they would quickly replace anything that was taken from it. He had been very much pleased with an expression of opinion so marked in favour of their staff. They had done their duty well and faithfully. At the crisis of the Egyptian campaign they had work which was not only daily but hourly, and their attention had continually to be on the stretch. He might mention as to the attitude which the company then preserved that they had three ships chartered at one time ready for emergencies. They had had to pay for that indeed, but they had found their returns from it. He was very glad to find that the action of their people had been so appreciated, and the directors would give due attention to the suggestion made.

Mr. Newton said that it did not appear that any increase in salaries and wages had taken place.

The Chairman said that both the board and the staff understood their positions. The latter knew their value; but they might depend upon it that the directors would duly attend to their interests.

The motion for the adoption of the report was then put and carried unanimously.

The Chairman then moved that Lord Arthur Sackville Cecil, who now retired, be re-elected a member of the board.

Mr. Nicol seconded the motion, which was carried unanimously.

Lord Cecil briefly expressed his thanks.

The Chairman also moved the re-election of Lord Alfred Paget.

Sir James Anderson seconded, and it was likewise unanimously carried.

Lord Paget having thanked the meeting,

Mr. Rickson moved the re-election of Mr. Henry Dever and Messrs. Quilter, Ball & Co. as auditors, at a joint remuneration of 100 guineas.

Mr. Newton seconded the motion, and the election was carried unanimously.

Mr. Rickson suggested that the time had come to consider whether the remuneration of the directors might not be largely increased (hear. hear).

Mr. Abbott said that at next meeting he should himself undertake to propose an increase of their fees (hear, hear). In the meantime, he was sure all would join him in tendering their heartiest thanks to the board, and particularly to the Chairman.

The motion for a vote of thanks was carried by acclamation.

Mr. John Moore said this perhaps afforded an opening for a question that did not come fairly into the discussion on the report. The shareholders would like a word of explanation. Sir James Anderson was at the present time the chairman of a news agency, a news exchange, and thus competing with their best customers.

The Chairman: Let me ask you one question. Are you connected with the Central Press?

Mr. Moore: I am a journalist.

The Chairman: This is not the place to discuss such a matter. I am as anxious as any of you to have this matter investigated. I stand, however, here to say that the imputations that have been thrown on this company from certain quarters we treat with the most perfect contempt. We stand far too high to feel in the slightest degree any insinuations such as have been thrown out against us (hear, hear). We have done services which (I speak generally) it would be impossible to do better (hear, hear). I am perfectly prepared to stand by the side of Sir James Anderson and defend him (hear, hear).

Mr. Moore: May I ask one point? Is it true that our clerks acted as correspondents for the Exchange Company?

The Chairman: That is not true; I can answer that question.

Mr. Nicolson: I beg to move a cordial vote of thanks to Sir James Anderson under the exceptional circumstances (hear, hear).

Major Leslie seconded the motion, which was carried by acclamation.

The proceedings then terminated.

Phœnix Electric Light and Power Company (Limited).

A MEETING of the above company was held at the offices of the company on Tuesday, the 23rd inst., in pursuance of a notice to confirm the resolution to wind up voluntarily, passed at the meeting held at Cannon Street on the 5th inst.

There were present 30 shareholders, including directors, &c.

The Secretary read the minutes of the last two meetings, which, however, were not put to the meeting and confirmed.

After the secretary had read the minutes of the last meeting, and the notice calling the present meeting,

The Chairman stated that as the matters in connection with this company had been so fully discussed at previous meetings, it was not necessary that he should again go into the arguments; he would therefore at once move—"That the resolution carried at the last meeting, to wind up voluntarily, be confirmed."

Mr. C. P. Whiteley stated that he would not trouble the meeting with many remarks, as the subject had now been well thrashed out. He gave notice that he emphatically protested against the manner in which the last meeting had been conducted, and challenged the alleged passing of the resolution to wind up voluntarily on the poll, as being irregular and illegal. The secretary had read from the minutes that the poll was duly demanded by five shareholders in accordance with the articles of association. This, however, he absolutely denied. The demand for the poll was made by the chairman alone, and the poll was therefore illegal. That being so, the amendment to the effect "That the company be wound up compulsorily under the High Court of Justice," and which had been previously carried on a show of hands, remained good, and the poll fell to the ground. Independently of that, a proper scrutiny of the poll had not been permitted, so that it was impossible to get at a proper analysis.

Mr. Tompsett stated that he thought the thanks of the shareholders were due to those gentlemen who had taken up this matter in opposition to the directors, and were endeavouring to bring things to the light that would be smothered up under a voluntary winding-up. If a few more companies of this, he might perhaps say "bogus," kind were shown up by men of public spirit, it would be the means of preventing thousands of pounds being lost by poor shareholders who could ill afford to lose their money. He hoped that if any shareholder were present who had decided to vote with the directors to-day, he would re-consider the matter, and upon the facts that had been placed before them record his vote against the company being wound up by the directors, who had mismanaged the concern from the very beginning. They had been told that they had £737 cash in hand in November last, but he wanted to know what amount of cash they had in hand at that moment, also what liabilities they had, and he wished to have the agreement produced in which it was provided that the money should be repaid by the vendors.

A Director stated that though a poll had only been demanded by the chairman, the demand was made on behalf of five shareholders.

A Shareholder ridiculed this idea, and stated that at the meeting the demand was made by the chairman alone, and nothing was said about the five shareholders. If five shareholders had demanded it, their names should have been given to the meeting.

Mr. Gilmore took exception to the statement in the circular issued by the directors to the effect that full explanations had been given by the directors at the statutory meeting. He was present, and begged to say that a good many questions had been asked by shareholders, but that they had not received full answers to them.

A Shareholder asked to be informed what were the assets of the company, and also what would be the difference in cost between winding up voluntarily and compulsorily.

Mr. Rawlins, solicitor, stated that a compulsory winding-up would simply mean that no single step could be taken nor a cheque drawn without the intervention of the Court. It was a mistake to suppose that the matters of the company would undergo a public investigation under the Court, as everything would be done in chambers and nobody would be any the wiser. He was surprised at Mr. Whiteley's persistence in pressing for a winding-up compulsorily, as, when the petition was brought before Mr. Justice Fry on Saturday last, it was agreed by Mr. Whiteley's counsel that the petition should stand over in order to enable the resolution to wind-up voluntarily to be passed.

Mr. C. P. Whiteley said that he was exceedingly surprised at the statement just made by Mr. Rawlins, and had no knowledge of the agreement referred to having been entered into, and for his own part could not believe it. He protested strongly against the solicitor making an *ex-parte* statement of this sort. There were two lawyers present in the company's interest, but his own solicitor was not allowed to be present, and therefore he was unable to directly refute the statements made. However, the main issue remained the same, and they had to choose between allowing the company to be wound up by the directors, or insist upon the winding-up being under the Court. He objected to the company's solicitor trying to shelve the question by raising a side issue which had nothing to do with what they were there to determine.

The Chairman stated that their assets consisted of £5,400, to be paid when the lamp was resold by the vendor, £3,000 unpaid calls, and £400 cash in hand. The liabilities were not much, the only serious one being a bill of exchange for £434.

The Secretary then read the clause in the agreement with the vendor, from which it appeared that in the event of the stipulated periodical payments for purchase of the lamp not being kept up, the contract should be annulled; and in the event of the vendor reselling the lamp, the money already received by him should be returned.

After some further discussion, the Chairman moved—"That the resolution to wind-up voluntarily, passed at the meeting on the 5th January, be confirmed, and that Mr. Bishop be appointed liquidator."

This resolution was lost upon a show of hands, only eleven voting for it, including the directors, &c., and nineteen voting against it. The directors, however, demanded a poll, and the proceedings terminated.

We understand the poll was kept open until 5 o'clock.

[We have received the following communication from Mr. Whiteley.—EDS. ELEC. REV.]

PHŒNIX ELECTRIC COMPANY.

To the Editors of the ELECTRICAL REVIEW.

SIRS,—My attention has been called to your having printed *in extenso* a circular issued by the directors of this company. As this is really an *ex-parte* statement while the matter is still *sub judice*, I must ask you in all fairness to insert my reply to that circular.

Yours truly,
CHAS. P. WHITELEY.

76, Queen Street, E.C., *January 24th*, 1883.

76, Queen Street, Cheapside, E.C.,
London, *January 17th*, 1883.

TO THE SHAREHOLDERS OF THE PHŒNIX ELECTRIC LIGHT AND POWER COMPANY.

GENTLEMEN,—I have just received the directors' "refutation" to the statements contained in the circular of the 10th inst., and am quite satisfied that if any unprejudiced person will quietly read and consider the circulars side by side he will have very little difficulty in coming to the conclusion that the directors have not proved themselves to be worthy of that confidence they now ask you to place in them.

With regard to the clipping of Professor Varley's report, you doubtless have retained your prospectus, and I only ask you to look at it and see whether the certificate (printed in red ink) *is printed in its entirety, as is now asserted by the directors.* You will see that a portion of the certificate *has been suppressed.*

Whose is the gross and flagrant mis-statement, mine or the Directors? How the Professor's opinion is enhanced in value by the statement that without a test of long duration he arrived at his opinion, I am at a loss to see. Nothing has been said against the value of the lamp; it was the certificate that was called into question. The value of the lamp has nothing to do with us now, and need not be discussed, and the money to be recovered from the vendor does not depend upon that, fortunately for us. This money is the subject of agreement entered into by the vendor, which agreement the Court will doubtless in due course see properly carried out.

Which of the directors increased their holding of shares? One held five shares, and now holds ten; but what about the sixth director, Sir G. Meredyth, whose name appears on both prospectuses? Did he ever increase his first payment of *half-a-sovereign?* This is all I can find credited to him in the register of shareholders. I am informed that three gentlemen joined the board after the prospectuses were issued. Why did they so quickly retire from that honourable position?

Are you aware that this patent was in the first instance sold for £20,000. In a very short time the price we were made to pay was increased to £70,000. Not a bad profit for somebody. Who was it?

The misunderstanding with Messrs. Foster, Hight & Co. still remains as great a mystery as ever. The directors do not give us the details of the dispute, nor the amount that was paid to settle it, nor how much was wasted in legal expenses in its arrangement. If the claim was a reasonable one, why did not the directors take the precaution to ascertain its validity and deal with it at once, instead of forcing the claimants to present a petition to get their just due? Is not this the object of the present petition, to secure the *rights of the shareholders*, and to see that our just claims are also properly attended to? Has Messrs. Foster, Hight & Co.'s claim anything to do with the introduction of a gentleman as a new director who afterwards retired, not liking the appearance of matters?

The directors say that the paragraphs in the circular as to the show of hands and polling are flagrant mis-statements. This I deny, and appeal to those shareholders who were present at the meeting to say whether the directors' assertion that only 37 shareholders were present, including themselves, is correct or not. According to their own showing, however, the sense of the meeting was largely against them, for they admit that only seven held up their hands in their favour, including directors, promoter, &c. Again, they state that a large majority of those voting against the directors they struck off on the poll, because they had not paid up in full. It is peculiar that several of the directors' partisans holding one share each did not see fit to pay their sovereign each (or any portion of it) until December 20th. Palpably this was done to swell the voters on the directors' side. How many shares belonging to Mr. Waters, the promoter and his nominees, are included in the voting? I happen to know that 13 shareholders' proxies were included who have since expressed themselves in favour of the petition, but omitted to get their proxies returned.

The directors say they simply desire to place before you plain facts, leaving them to speak for themselves, and I desire no more. I am confident of the result, inasmuch as out of the total of 13,691 shares allotted, holders of 7,641 shares are in favour of the petition, 2,000 shares in litigation with the directors, 1,615 shares held by directors, 132 shares whose owners' addresses are not known, the small minority of 2,308 shares being divided amongst those who have expressed no opinion one way or another, and those who are opposed to the petition.

I trust you will agree with me and the large majority of original shareholders who are supporting the petition, and insist upon the affairs of this wretched company being brought to the light of day under the auspices of the Court.

The petition will in all probability be heard within a few days, but in order to show the directors that the shareholders have taken the matter out of their hands, I beg you will be good enough to sign the enclosed proxy and send it to me by *return of post*, as the proxies must be given in by Saturday. Please observe that a penny stamp must be placed in the space marked for it. The form of proxy sent you by the directors will suffice, provided you strike out the directors' names, and insert Mr. Hough's name or my own, and initial the alteration.

If you have already, through inadvertence, signed the directors' form and returned it to the secretary, please write at once to him and recall it, and apprise me of the fact.

CHAS. P. WHITELEY.

P.S.—The directors complain that they and their friends have not received copies of the last circular. I have to intimate that if I had the company's cash-box at my elbow, as they have, I would willingly send as many copies as they thought they were entitled to. As it is, however, I do not care to go into more expense than necessary, and must confine my communications to those who are likely to agree with me.

The Cuba and Submarine Telegraph Company (Limited).

THE report of the directors of this company for the half-year ended 31st December states that the gross receipts, including the balance brought from last account, amount to £17,012 6s. 8d., and the gross expenditure, including the half of the annual payment for the new cable, to £6,012 9s. 7d., leaving a sum of £10,999 17s. 1d. to the credit of revenue account. After placing £1,325 to the reserve fund, increasing that fund to £49,500, and providing for the dividend on the preference shares, a balance of £6,674 17s. 1d. remains, out of which the directors recommend the payment of a dividend on the ordinary shares at the rate of 7 per cent. per annum, free of income-tax, leaving the sum of £1,074 17s. 1d. to be carried forward to the current half-year's account. The cables have continued in good working order, but Mr. Keith, the company's engineer, reports a small fault in the 1875 Cienfuegos-Santiago one, which he recommends should be cut out. An early opportunity will be taken for doing this, the cost of which it is estimated will not be great, the fault being near Cienfuegos in shallow water. The Central and South American Company's cables having been completed and opened for traffic, they are now competing with this and the West India Company's lines for Colon and Panama business. A reduction has been made in the tariffs to meet the competition. The 23rd ordinary general meeting of the company will be held at the company's offices, 61, Old Broad Street, on Wednesday afternoon at one o'clock.

The Anglo-American Brush Electric Light Corporation (Limited).

AN ordinary general meeting of the shareholders of the above company was held at Cannon Street Hotel, London, E.C., on Tuesday last, Sir Henry W. Tyler, chairman of the company, presiding. There was a crowded attendance. The members of the board on entering were received with cheers and some hisses. On rising to make his usual statement, the Chairman said that they had last met on the 2nd of August, and it had not been a happy meeting: it was a very miserable meeting. They had called the shareholders together to ask their permission to declare a very large dividend. There had been before that time a mania for speculation, and every one knew too well that after such a mania there must come some reaction and some disappointment. The reaction had been even more severe than any of them could have imagined, and there must have been a very serious disappointment among those who had bought the shares of that company when the mania had run them up very high indeed. But to-day their task was a much more congenial one (laughter). They had to reply to accusations that had been freely advanced against them, and he trusted they would do so to the perfect satisfaction of the shareholders (hear, hear). They had to reply to accusations; but their duty was not to caution investors, but to uphold the claims of that company before the world. The shareholders had received the report and the balance-sheet which they had issued; he had no doubt they had all studied it carefully and would take it as read. As no doubt a great many questions would be asked, he would like to give explanations as full and as fair as it was possible for him to give, and he would undertake to answer all questions to the best of his power. Coming to the accounts, the charge most levelled against them was connected with the last item of their expenditure as given, viz., commissions and special discounts on sales to licensee companies. They had printed these, which comprised the total for the whole year, as they saw, for everybody to examine. The first item, then, of their expenditure account was salaries, which included directors' fees, £25,896 14s. 3d. (laughter). That was a large amount; but it was nothing more and nothing less than what was authorised by the articles of association to be paid in proportion to the concessions made and the dividend paid to the shareholders. He only wished, for the shareholders' sakes as well as their own, that they had further concessions from which they might derive benefit in the future. But still, with regard to fees, he would say that if they had foreseen the excessive reaction which had taken place, they would not have taken those fees which they did take in August last. It was not, however, in their power to foresee what had subsequently happened. Further, he might add that they had not taken their fees for the present half year, and after consulting with his colleagues last evening, they had decided not to accept further fees until the company had paid upwards of 10 per cent. again. He hoped that would be satisfactory (cheers, with some dissentients).

The miscellaneous charges, £2,740, had arisen on account of experiments in the manufacture of carbon. They had had at one time very great difficulty in getting suitable carbons, and they had gone to a good deal of expense in learning how to manufacture them. That included also what they paid for gas and water, and a variety of other purposes. The postal and telegraphing account contained nothing that he need remark upon, neither did the rent account. The coal account came to £1,543. They must remember how much coal they necessarily consumed with all their engines at three different sets of works, and also at their various offices. It was not a heavy item, especially in London, where coal was rather dear; the advertising account, £670, was nothing more than could be fairly looked for. The carriage account seemed large, £3,674, but that was on account of their apparatus and machinery being carried to and from all parts of the world. A large proportion was chargeable to carbons received from America, which they not only used themselves but sold to their customers in different parts of the world, having of course to pay their carriage The insurance account was only a matter of prudence, and not at all too heavy, £226. The law charges might seem a large sum, £3,763, but in fact not much more than half of that was for law charges proper, because a great deal had been paid in fees to counsel and as retainers to scientific witnesses. They had been threatened with an action, which was still pending, in which it was claimed that the Brush patent was an infringement. They felt perfectly confident as to that, but they had been advised to retain scientific witnesses that they might be in a position to defend that action properly. Rates and taxes had absorbed £2,860. Continental and travelling expenses seemed a heavy item, £3,456, but they had been obliged to employ gentlemen to travel about the Continent a good deal, and not only so, but in order to make their patents valid in different parts of the Continent they had to spend money in manufacturing their apparatus on the spot. All that ran away with money, and so bulked the account. The Crystal Palace Exhibition expenses were £1,369. He did not think any one would suppose that they had expended that money wastefully. Nobody grudged it more than the board did, but they thought they ought to show something that would be a credit to them; it had been a success, and had done them good in several ways. The lighting contract account, £1,596, they had been a good deal taken to task about. Many had supposed that this represented a dead loss of £1,500 on lighting contracts for the year. That was an entire mistake, because they had received for these contracts a large sum which was not shown in that account. The stationery and Paris Exhibition accounts were neither of them heavy. Over the next large sum of £39,791, as commissions and special discounts, and sales to licensee companies, as per agreement, they had been fiercely attacked. It was a most fearful item, they were told; they were most extravagaut people, mismanaging everything, and there must have been a great deal of jobbery over the transactions which that sum represented. Now, would they be surprised to hear that that item was simply made up of the discounts which were allowed to sub-companies. On sales of apparatus to these companies under agreement they had allowed 20 per cent. discount, and in some cases of large orders even a larger discount had been allowed. The total was almost entirely made up of such allowances. All these items, then, made a total of £102,832. As regarded the balance-sheet, the great feature there was the value of the property and the value of the stocks which they now held in their possession. The value of the property was £66,491 and of the stocks £93,034, making a total of £160,000. It was a very large amount of property to have in hand—very much larger than they liked to have. As the shareholders were aware, however, the company had found last half-year that the demand on them for apparatus was more than they could supply with their existing manufacturing appliances. In order not to be caught napping again, they took extra premises and fitted them up with extra machinery. They had now got in these factories as fine a set of machinery as they could wish to see, and they had manufactured a very large amount of stock. No one, however, could imagine for a moment that that stock was now valueless to them. Electric lighting would take a fresh start when the act came into force and provisional orders were obtained. Even if the demand did cease, the factories would be available for manufactories of almost every description of machinery. He did not therefore think that either this large stock or the extra premises would be wasted. There was in the balance-sheet a sum of £50,000, they would observe, to be received from Mr. Lane-Fox in March next. He would have more to say about that shortly. As to the appropriation account, they had written £132,000 off the purchase-price of patents and 10 per cent. off for depreciation of plant, buildings, &c. They thought that was fair, instead of carrying forward an amount which would look so very large indeed. He would only now just glance at a brief *résumé* of this company's history. It had been in existence two years. In its second half-year this great speculation had been set up, and they had been at one time nearly torn to pieces by people wanting to buy concessions. The result of that prosperity was that they distributed 100 per cent. dividend last August. They were now told that having regard to the present position of the company they should never have distributed so large an amount. They had been glad to return to every shareholder the money that he had paid, but another reason that made them anxious to distribute this money was that the £4 paid shareholders, being the most numerous in the company, seriously threatened to force them to make a call upon their shares. They would thus have realised very largely, as the shares were then at a very high premium. The bone of contention was gone when the 100 per cent. dividend was divided. The corporation had since been unfortunately obliged to make a call (laughter), though they had put it off as long as they could; but the very people who wished last year to force them into making a call, cried out against them for doing so now (hear, hear). Here, however, they had a magnificent stock, ready to turn into money as soon as the tide set in favour of electric lighting, and he had no doubt they would then be able to dispose of it at a large profit. They had been subjected to many attacks from the press, and some complaint had been made that they had not defended themselves. There was the impartial press, and that they *would* answer if misleading statements crept in. Another class of paper of which they had seen much lately, inserted reports for the sake of circulating so many copies amongst shareholders whom some interested party wished to influence; a third class simply existed for purposes of slander. These latter had attacked them, but they had thought it best to refrain from noticing their statements. Some alarm had been caused by rumours of litigation connected with the company. There was that action pending against them by the grand company, and they themselves were suing somebody for bills which had been protested and not paid; but further than that he could assure them there were no grounds for the alarm. Now as to their relations with the Lane-Fox lamp. Before Mr. Lane-Fox came to them he had dealt with the British Electric Light Company, but finding his dealings with them unsatisfactory, he had paid a considerable sum of money to get back his patents, allowing them, however, the use of his lamps without his name. This corporation had paid him a certain number of shares, and agreed to give him a proportion of profits; but seeing that they had not the exclusive right to his patents, they had refrained from asking any price whatever for them from their licensees. They sold the Brush patents and gave the licensees the Lane-Fox lamp. They had always stated honourably that they had no exclusive right, but unfortunately—*how*, it was not for him to explain—some of the prospectuses were issued in the hurry of the electric light mania, into which the word *exclusive* had slipped. That was their position as to the Lane-Fox. He knew that at that meeting some dissentients were present. Mr. Gillet and his friends had issued a circular to the shareholders. They looked on their proceedings with all respect, and doubtless their proposals would be fairly discussed. They had given them what information they could, and even asked them to nominate a gentleman for the vacancy on the board, though they had not yet done so. Mr. Lane-Fox, however, was in a different category from these gentlemen. He ought to be working with the corporation instead of assailing it. The contract by which Mr. Lane-Fox had contracted to pay £50,000 in March had been none of their (the directors') seeking. He had bought back the remainder of his patents under that contract, but finding perhaps its fulfilment a little onerous, he had come to them last Wednesday week and asked to have set off against that £50,000 whatever little matter might be in account against them, giving them at the same to understand that he could make matters very disagreeable if they did not agree to do so. They had declined his proposal, and the result was a letter from Mr. Lane-Fox to the newspapers, stating that our report misrepresented the company's affairs, and was calculated to mislead as to the future of the company, declaring his intention of moving for a committee of investigation, and recommending the shareholders not to send proxies but to attend at this meeting personally. That was the first instance he (the chairman) had known of a gentleman taking advantage of a time of agitation to sow dissension in a company with which he had been engaged in complicated transactions for his own private interest. (Hear, hear.) He would only add that the directors would not shrink from difficulties when they arose; and if now or at any other time it pleased the shareholders to relieve them from their functions, he would be the happiest man in the world to accept relief from a position of so much trouble. He would conclude by moving that the report and balance-sheet for the year be adopted.

Mr. Sellon seconded the motion. He did not hesitate to assert that the shareholders possessed the most valuable electric light patents that existed. The absurdity of asserting the worthlessness of the Brush patents had been proved by the inability of three years' ingenious efforts to invalidate them, and by the extension of the system to its present dimensions, upwards of £600,000 worth of Brush electric lighting machines had been made in England in one year, and over 25,000 Brush lamps were now at work throughout the world—an aggregate larger than that of all other lamps put together. The London city lighting had been done for two years with a machine that had not cost 5s. for repairs, and in New York a circuit of 38 miles in length had been wrought from one centre. No other system could accomplish such results. There was nothing to fear from such other modes of lighting as that of alternating currents or continuous low tension machines. The former caused rapid deterioration of plant, and interfered seriously with telegraph and telephone wires in the vicinity, and the Brush itself could act as a low tension machine more successfully than any rivals. He believed that at this moment they really commanded the electric lighting of the world.

Mr. Gillet, who was received with loud cheers, begged to move as an amendment that a committee of shareholders be appointed to consider and report on the affairs and position and general conduct of the corporation. He felt very much disappointed with the report which had been presented, and there had been for some time a widespread feeling of suspicion and dissatisfaction among the shareholders (hear, hear), and they should do all in their power to remove that feeling once and for all. The wisest course, he believed, would be to appoint a committee, as suggested in his amendment, to go thoroughly into the books and report to a future meeting (hear, hear). Sir Henry Tyler's elaborate statements had not satisfied him. For one thing they were inconsistent with statements made by him at previous meetings. He had laid it down as a sound principle at the meeting last January that profits of manufacture should go to dividend, and sale of concessions to reserve fund (hear, hear). Why, then, had he advocated a departure from that principle (hear, hear)? In July he had carefully kept back all figures, so that the shareholders could only judge by his statements, but at the August meeting he advocated one hundred per cent. distribution, and stated that he went by the principle of never touching capital but only dividing profits. Then we would naturally expect that the company should have had large funds in hand, quite sufficient to meet its engagements for a very long time. But this report told them that in November, only three months after, the position of the company was entirely changed and that a call had to be determined on. He thought they ought to have a little further explanation (hear, hear). The chairman might be—unintentionally, doubtless—misleading them, as he appeared to have done in August (hear, hear). He wanted their real position brought out and the feeling of mystery and dissatisfaction dispelled. The chairman had made a great point as to the directors deciding not to draw their fees for the last half-year. Probably it might be found that they had only the £1,500 to draw to which they were entitled, and no such sum as the £25,000 down in the accounts (laughter and hear, hear). Again, as to the £39,791 charged as concessions and discounts, if it represented rebate of commission on the sales to sub-companies he should like to know what was meant by the £58,000 deducted from the sales of concessions on patents (hear, hear). They could have no satisfaction as to these profits unless the books were before them. The whole success of electric lighting was largely dependent on public opinion with regard to that company (hear, hear). No very extensive inquiry by a shareholders' committee would be necessary; but he contended that that inquiry in some form was absolutely necessary for the satisfaction of the shareholders and the restoration of confidence in the minds of the subsidiary companies and of the general public. He therefore moved this amendment (loud and continued cheers).

Mr. Robert Allsopp seconded the amendment.

Mr. Lane-Fox, who was greeted with applause, said that the chairman had made a contemptible attempt to cast discredit upon him. He ventured to say that that attempt would meet the success it deserved in an utter, hopeless, and miserable failure (hear, hear). He had not come there to serve personal ends, but in order to expose a most scandalous series of proceedings which he considered a disgrace to the board. He was sorry to speak thus, because he had at first been co-operated with two of its members who had since unfortunately been led into the evil ways of its directors (laughter). At his first connection with the company he had made an agreement by which he had received the sum of £5,000 in shares, he having accepted a liability of £7,500. Just previously to that he had paid the British Electric Company £5,000 to free his connection with them, allowing them to use his lamp without his name. He had attempted to cooperate with the company time after time, and they had utterly repelled him. He had made offers in writing, which were refused. He had on one occasion attended a board meeting to protest against the way in which he was being treated, and the chairman had told him that he did not believe in incandescent lighting, and considered it utterly impracticable, and that money spent on it was money wasted (hisses and "Oh, oh!"). As to his financial relations with them, it might be supposed that he had made immense sums out of the Brush mania. If he were quietly to accept all the statements of the directors he would be a loser to the extent of £40,000. He was entitled to his share of the profits, and he believed that the price paid by the public generally was largely on account of the connection of his name with the company (hear, hear). The prospectus stated that his inventions were a most important consideration. About two months ago he had been setting a legal action afoot, but when he discovered that the large sums that the company was stated to be in possession of never really existed, he felt that it would be no good to bring it. He had done a very generous thing subsequently in offering a compromise. If this policy of the board were continued it would be absolutely ruinous, not only as to the financial but the working policy. The chairman had stated that at the present time there was a great depression as to electric lighting; that statement was absolutely false ("Oh, oh!" hear, hear), as false as many other statements that he had made (renewed hisses and cries of "Oh, oh!"). The Electric Lighting Act had been an enormous assistance to the business of electric lighting. It gave privileges which could not have been obtained two years ago, and which ought to be taken advantage of. He considered the company started with magnificent prospects, but they were now driving hopelessly towards destruction. Their interests lay in the direction of united action. The shareholders should *make* the company do their work (hear, hear). The company had engaged over and over again to deliver machines, which it failed to do. They had turned instead their attention to a class of machine useless for electric lighting. They should obtain, first of all, a trustworthy board of directors, who would do the legitimate business of the company. The subsidiary companies bore him out in his statement that they had failed to supply machines as wanted. There would be during the next few months a demand to the extent of millions for electric business. If they would join in this action they would be successful, and obtain a large share in the profits. They had a great future, but they must get rid of the startling rumours that were flying about, and they must have a radical change in the policy of the board (hear, hear).

Mr. Alderman Whitehead called attention, in a long speech, to several items in the balance-sheet. He appealed to the board to accept the suggestion of Mr. Gillet and the appointment of a committee. (The Chairman shook his head.) Then it would be his duty to bring before them a few facts, and ask a few questions. How came it, he would ask, that £150,000 only appeared to have been received from the Metropolitan Brush for their concession, seeing that to his knowledge the amount paid was £175,000? (Hisses, "Oh, oh!" and uproar.) What had been done with the difference of £25,000? Then £11,000 worth of shares had been sold by the corporation. It would be a remarkable thing if they were sold exactly at par. If they were sold at a loss or a profit, where did these items appear (hear, hear)? Then he would ask was the account at the bank ever overdrawn, and to what extent? Was it not largely overdrawn at present? Were any of the accounts owing to the corporation disputed, and had any deduction been allowed? The item of £9,800 due to Lane-Fox was stated in the account to be in respect of the *sale* of his patents. How was that to be taken, since the chairman had said the Lane-Fox lamp was not sold but given away? (A Shareholder: "Foreign sale.") The item of £50,000 due from Mr. Lane-Fox he looked on as a very doubtful asset indeed, and many of the items were clearly subject to much deduction. By making these deductions he firmly believed that the surplus of £109,338 would be turned into a deficit of £53,611. Special explanation was needed as to the item marked "Continental and travelling expenses." He attributed much of their present bad position to want of business capacity on the board. The sales of commissions, &c., they had managed very cleverly, but they had not managed the manufacturing business of this company in the way they ought to have done. It was within his knowledge that for five months the sub-companies could not obtain dynamos suitable for incandescent lighting, and at last so helpless did the directors become that they at last agreed that the dynamo of another inventor might be used by their sub-companies ("Oh, oh!" and hisses), and also had permitted a company actually using the incandescent lamps of another inventor ("Oh, oh!" "Shame!"). He would be much surprised if the shareholders did not demand a committee. Such a committee would clear the air and place the company in a better position than it ever had occupied (hear, hear).

Mr. George Offor, as chairman of two of the sub-companies, expressed his confidence in the dynamo high-tension machines manufactured by the company.

Mr. Wm. Abbott had never known an investigation committee do any good, and such an appointment would do them no good. He hardly thought a committee would be anything but detrimental.

Mr. Dashwood believed that the appointment of such a committee would operate greatly to the advantage of the company.

Mr. Sutherland would suggest to the directors that they should receive a deputation of shareholders and give them the explanations they required.

Mr. Felks said the amendment was not necessarily hostile to the board. If the committee reported favourably there would be no opposition to the continuance of the directors. He would support the appointment of a committee, however, simply because the board opposed it, because that looked as if there was something to keep back (hear, hear).

The Chairman, who was received with cheers and hisses, said he would take the points that had arisen one by one. As to shares dealt in by himself he had never bought one, but he possessed a great number by virtue of what he held in a previous company. These he had sold—at comparatively low prices, he was sorry to say. Independently of these, he had never bought or sold a share. Now, as to the Metropolitan concession. They had been addressed by two parties, each of which wished to purchase that concession. They were in a difficulty which to deal with. It was agreed at length that one gentlemen should get it at 5 p.m. on a certain day if the other did not deposit a cheque by that time. The time passed, and it appeared as if the former had obtained the right to the concession. However, one of their officers came with the cheque shortly afterwards, and it had been handed to him before the hour. Hence the board allowed the gentlemen to settle it between them, so long as they got the £150,000 bargained for, which sum only was paid. The balance went to one of the bargainers—Mr. Walter Webb—by private agreement with the other. The board had nothing to do with it. That was the whole story. The sale of shares commented on by Mr. Whiteley was at par, so that neither profit nor loss had to be accounted for. There *was* a blunder as to the date of meeting, but that arose through the original arrangement having to be broken on account of the corporation being unable to secure the accommodation that they desired on the day named. Hence it was altered, but the date on the circular was neglected to be altered to correspond. As to failure to supply machines, he found that the Metropolitan Brush, of which Mr. Whitehead was a director, had applied as a special favour to be allowed the use of a Siemens machine to light Willis's rooms with Swan lamps. (Mr. Whitehead: Because we could not get a machine from you.) The balance at the bank *was* overdrawn and largely ("Oh, oh!" and hisses). Why otherwise should they have made a call of £3 per share? Mr. Lane-Fox had made some serious charges. It was a marvellous statement to hear him say that he (the chairman) had condemned incandescent lighting. He *did* say that it was very difficult to make it pay. Mr. Lane-Fox's connection with the Portpool Lane part of their works had been disastrous to them. He (Mr. Lane-Fox) had appointed there a man who was quite incompetent, and it was that part of their business which paid them worst. A committee of investigation they would be the first to welcome, and nothing would give them greater pleasure if it was for the interests of the company. The effect, however, of appointing such a committee would be the publishing of a report after searching through their trading account. That would tell everything to their rivals and enemies—and they had many of them—and he thought they would not be worthy of their places if they did not resist such an inquisition. Therefore we could not consent to that committee of investigation (hisses and cheers).

The amendment was then put to the show of hands, and the chairman declared 86 to be in its favour. On calling "to the contrary," about 60 hands were held up. After counting, the chairman said: "I declare that the amendment is not carried. Anybody may demand a poll who likes." (Cries of "Shame," "No, no!" "What were the numbers?" and hisses.)

A Shareholder: On what grounds is the amendment not carried?

The Chairman: I do not think they knew what they were voting for. We will have it again; I only want to do it fairly. (Laughter and cries of "Numbers," "Sit down," "Shame," and "Oh, oh!")

The Chairman: The numbers I took were 86 and 60. (Cries of "Hurrah" and "Shame.")

A Shareholder: Will you put the amendment as a substantive motion?

The Chairman: If you will allow me, I will conduct this meeting according to the articles of association. These state that the declaration of the chairman as to a vote should be received unless a poll is demanded by gentlemen holding shares to the amount of one-fifth of the share capital of the company. Our solicitor advises me that the proper mode is to declare the amendment not carried, and Mr. Gillet, if he thinks proper, may demand a poll (hisses).

Mr. Gillet said the ruling of the chairman was entirely wrong. But if he thought he had that power given him by the articles, then he demanded a poll. The ruling ought to be by the show of hands.

The Chairman: I declare the amendment carried.

Mr. Sellon: On behalf of the directors I demand a poll.

The Chairman: The poll will be held this day week at this place from two to five o'clock.

The meeting, which had lasted for three hours, then separated amid considerable confusion.

The Oriental Telephone Company (Limited).

ON Wednesday at noon an extraordinary general meeting of the members of the above-named company was held at the City Terminus Hotel, Cannon Street, for the purpose of considering and, if thought advisable, passing certain resolutions.

Mr. John Pender, Chairman of the company, presided, and (after the reading of the notice of meeting and the minutes of the last meeting) said: This is a special meeting, called for the purpose of altering the articles of association. When I last had the pleasure of addressing you I referred to the general progress which the company had made; I also referred to the fact that we were in negotiation with parties in Bombay for the formation of a company. That has been completed, and it requires after the end of the year two or three months—in fact, quite three months—to elapse before we can get home all the accounts and submit our annual balance-sheet. We therefore thought that as some applications had been made by different shareholders as to a dividend, that it was desirable we should have the power to declare interim dividends. We had the money and, therefore, thought it was better—as this alteration must be made in our articles of association to enable us to pay an interim dividend—to do what was needful at once, and at the same time to pay the dividend which we propose to declare. The first resolution is:—"That the Articles of Association of the company be, and the same hereby are altered by rescinding Article 48, and that in lieu thereof the following article shall henceforth be Article 48, viz.: '48. Every member shall have one vote for every share held by him, and every holder of a share warrant shall (subject to the provisions of Clause 23 being complied with) have one vote for every share warrant held by him. In case of an equality of votes at any general meeting or poll, the chairman shall be entitled to a second or casting vote.'"

The resolution was seconded by Mr. P. Carniegy, C.I.E.

The Chairman asked if there were any remarks to be made, adding his opinion that they were simply now making amendments in the articles of association which should have been made in the first instance.

The resolution was then put and unanimously carried.

The Chairman next submitted the following resolution :—"2. That the articles of association of the company shall be, and the same hereby are altered by the following article being inserted after Article 79, viz. : '79a. The directors may of their own authority from time to time determine on, and declare an instalment to be paid to the members in proportion to the amount paid up or deemed and taken as paid up upon their shares on account, and in anticipation of the dividend for the current year, but so that the aggregate amount of such instalments in any one year shall not exceed a dividend at the rate of 20 per cent. for the year.'"

Col. Gouraud seconded the resolution, remarking that its terms were so obviously in the interests of the company that he did not think any special comment necessary.

The resolution was unanimously adopted.

The Chairman then read the third resolution, as follows :—

"That the articles of association of the company be, and the same hereby are altered by rescinding Article 82 of the articles of association of the company, and that in lieu thereof the following article shall henceforth be Article 82, viz. :—'82. Every dividend and instalment of dividend or interest shall belong and be paid (subject to the company's lien) to the members who shall be on the register at the date when such dividend or instalment of dividend shall be declared, or interest shall be payable, notwithstanding any subsequent transfer or transmission of share.'"

Sir Alexander Armstrong, K.C.B., was the seconder.

Carried unanimously.

The Chairman then explained that these resolutions had to be confirmed, and when this was done at another meeting, to be held as soon as legally possible, the dividend would be declared. They would be enabled to pay it during the next fortnight or three weeks. Had the directors delayed altering the articles until April the chances were the shareholders would never have had the dividend before May. I might (he continued) say in passing that I hope, probably by the time I have the pleasure of addressing you in May, that we shall be able to announce that in Egypt we have established another company on a very satisfactory basis. Alexandria, even since I last addressed you, has progressed in such an encouraging way that I think we may look forward to a very good exchange there. The Government are taking it up, and I think when Alexandria has been reorganised and rebuilt we may look for a very satisfactory state of things there. In Singapore and elsewhere things are all progressing very much as I stated when I last addressed you. I have to thank you for attending to-day. I thought, and still think, that we have the right to pay this dividend, but as the solicitors did not think so, I thought the best way was to bring you together and put the thing into such legal form that there could be no after reflection (hear, hear).

The proceedings then terminated.

The Yorkshire (Brush) Electric Light and Power Company (Limited).

ON Friday, the 19th inst., an extraordinary general meeting of the shareholders of the above-named company was held at the City Terminus Hotel, Mr. W. H. Lowe presiding, "for the purpose of considering an offer for the repurchase from this company of the Lane-Fox licence, for the sum of £35,000, payable in fully paid-up shares of this company, and, if then considered desirable, to pass resolutions authorising the board of this company to carry out the sale of the said licence upon the above terms, or upon such other terms as the meeting may decide."

The Secretary having read the notice convening the meeting,

The Chairman said : Gentlemen, when I last had the opportunity of addressing you I mentioned that the directors would take every opportunity of doing the utmost in their power to bring about a satisfactory settlement of this question of the Lane-Fox patents. We have been trying to make terms with the Hammond Company for this purpose. It has occupied a long time, and has been a trying, wearying, anxious time for us to bring this matter to a settlement. We had many conflicting matters going on at the same time, so many actions going on against us ; but we pushed persistently on in view of bringing this matter to some settlement which we could lay before you, and as soon as we could obtain a reasonable proposition we immediately decided to submit it to the consideration and discussion of a general meeting in accordance with the terms of my promise at the last meeting, that we would take no steps without your approval. In a circular sent with the one calling this meeting we told you what the terms of the offer were. And I asked the shareholders who could not attend this meeting to give their views in order that we might obtain some idea of their opinions. The concensus of these opinions appears to be this, that the amount of the proposal is considered fair and reasonable, within certain limits ; but they one and all mention that it is considered essential it should be accompanied by a money payment. Well, the directors themselves have been very much impressed with that idea from the beginning, and held it in view in the course of their negotiations. They have been unable to obtain from the Hammond Company a proposal of a cash payment included in the cancellation of shares. We can discuss that matter to-day, and when you have decided we will endeavour to carry out the views of the meeting.

Mr. Whiteley : May I ask you to read the proposition ?

The Chairman : I find we have not a copy here. It is a short letter, signed on behalf of the Electric Works Company, offering to buy back the Lane-Fox licence, in consideration of the sum of £35,000, payable in paid-up shares in the company. Beyond that there were no conditions attached to it. It was a very straightforward letter.

A Shareholder : Was any cash paid to the vendors in the first instance ?

The Chairman : The terms of the prospectus were carried out. There was a cash payment. The company drew a cheque and handed it to the vendors in settlement of the claim—£50,000 in cash and £50,000 paid-up shares. That includes the Brush licence too. Because the two were lumped together and the exclusive right given with the Brush dynamo it was assumed that the two were exclusive.

A Shareholder : Of what value is the Lane-Fox concession as compared with the Brush ?

The Chairman : Its practical value is simply *nil*. We can get that lamp or any other suitable lamp without paying anything exclusive for it. We must bring ourselves to that position by the Electric Lighting Act. It is an all-round business ; the exclusiveness of one lamp over another is nothing.

Mr. Stobart remarked that their total capital now seemed to be £200,000 ; nominally it was £120,000, or £130,000. "These good people" promised to give this company back £35,000 worth of shares. But they must be absolutely valueless, as the chairman told them the lamp was of no value. So they would have bought back nothing, valued at nothing. They appeared to have got a good sum out of the Yorkshire company. The shares, it seemed to him, were worth nothing. The thing was in litigation, and would probably be in liquidation before long.

Mr. Whiteley : Who signed the letter making the definite offer ?

The Chairman : I have already mentioned that it was on behalf of the Electric Works Company, who are the nominal parties we have to deal with. But the exact parties are the Hammond Company.

Mr. Whiteley : I am glad to hear that the negotiations have been carried on with the Hammond Company, but the absolute offer has been signed by Kay & Co., on behalf of the Electric Works Company.

The Chairman : Just so.

Mr. Whiteley said under these circumstances he should object to the offer as being totally illegal, for the reason that they had received notice that the Electric Works Company were on the point of liquidation. If that were so, it was part of the law that people who were in liquidation could not make offers and sell shares. Besides that, having ascertained that the Electrical Works Company were in liquidation, they served them with notice claiming a large sum, on the understanding that they would undertake not to part with any of the assets. It seemed that the present offer, whatever it was worth, was in contravention of that promise. He was very glad to hear that after all the Hammond Company were the people they had really to deal with, and it was the more satisfactory, perhaps, because they might have better people to deal with. Most of the shareholders were doubtless aware that there was a petition down for hearing for winding-up the company under the auspices of the Court. Upon that certain inquiries had been made by Mr. Brown, the new solicitor to the company, who in an affidavit stated that he had found that the Yorkshire Company really *had* an exclusive licence for the use of the Lane-Fox. Assuming that that were true, then they still had the exclusive licence to the Lane-Fox incandescent lamp. If it were true, his petition fell to the ground. If it were true, how was it that the offer had not been withdrawn ? If they *had got* it why had the negotiations been carried on ? If this were true, they were practically asked to sell the only thing they possessed which was of any value—to sell for £35,000 in shares what they gave £100,000 for ; and so leave them wholly and solely by the Brush, which they heard from the Hammond Company had been superseded a long time since by the Ferranti.

Mr. Guadella, on behalf of the Electric Works Company, said Mr. Lane-Fox himself, personally, was prepared to make an affidavit in support of Mr. Brown's statement. Hence it had become clear that this company *did* acquire the exclusive right to the Lane-Fox lamp. It was as well to say that the counsel employed by the board of this company were of opinion that this company was in possession of the *exclusive* right. It was thus not merely on Mr. Brown's affidavit that the matter would rest when it came before the Court. Mr. Whiteley had said why did they not reject the offer ? Why, they had instructions from the officers of the Court to make the offer, and therefore the offer was made thoroughly legal, and was made to this company in a thoroughly legal way. He wanted, further, to remove from the minds of the shareholders one impression, and that was that the vendors had received a large sum in cash. He was prepared to prove to the shareholders, up to the hilt, that the vendors had not received cash. Whatever had been taken from this company had been taken in shares, and, moreover, the Electric Works Company were £5,000 "out"—money deposited in the first instance with the Hammond Company (Mr. Hammond : you have had it back in shares). Having quoted a number of figures, which some of the shareholders admitted they could not follow, and which the chairman ruled were irrelevant, Mr. Guadella said that it was found that certain parties, in order to work the company and carry out the prospectus, had to apply for shares. As regards Mr. Whiteley's last remark, why was it that the question remained open ? The question was, are you going to wind up or not ?—for other shareholders as well as Mr. Whiteley had taken action against the company. On the part of the vendors (the Electric Works Company) there was a general desire to clear the ground of this question, and see whether by making the offer the company could do any good in working its business or not. If this company thought the lamp of value, let them keep it. They wanted to abandon law and get to work. What prospects had the company of doing work and of getting more work ? His instructions were to receive whatever the meeting decided.

The Chairman said the legality of the offer had thus been disposed of. The cancellation of this licence did not leave the company in the hands of the Brush Company ; they were in the hands of the Hammond Company. The fear of their giving up the licence and of being unable to get the lamp if they required, was a matter of some importance. He found from the minutes of the board meetings that on the 11th of July it was resolved that the sum of £50,000 in cash be paid to the Electric Works Company by two cheques, one of £10,000 and one of £40,000. On the 14th of July it was resolved that in accordance with the agreement, the sum of £50,000 in shares be paid to the Hammond Company. That was all the directors know anything about. They know nothing of the intricacies mentioned by Mr. Guadella. The Board did not mix themselves up with the private arrangements of the vendors and vendees. The progress of the company was going on in a satisfactory manner. The lights at Middlesborough were increasing every week. They had promises of support from Middlesborough which were almost sufficient to keep this company at work. They had a large number of lights there, and continued to put more up every week. They had 16 lights at Dewsbury, 3 lights at the Theatre Royal at that town, 6 lights at Huddersfield underground market, and if these were approved of they would want 34 more, and they had 3 in the Huddersfield Theatre. These were all advertisements of a very important nature. They were not advertisements constructed by the company at their own expense; they were purely and simply orders. The board had for a long time ceased to advertise in this manner at their own cost. They charged the full, fair, and proper price, which was paid. They had 16 lights in another place, and small instalments in the Philosophical Hall, Leeds, the Cutlers' Hall, the Liberal Club, the Sheffield College, the Huddersfield Town Hall, and at Messrs. Balckow, Vaughan, & Co.'s. They had tenders now before them from several important local bodies, but the recent action of some of their shareholders had done them a considerable amount of harm. It had spoiled their credit in a large number of instances. People said, "Oh, I don't know what to do with you. How do I know you will carry out your order? I hear you talk of winding up." Such was the nature of the remarks made when an order was sought, and these remarks were naturally very injurious to their prospects.

Mr. Macallister inquired whether, if they accepted the offer, the Hammond Company would give them the monopoly of using the Lane-Fox lamp in Yorkshire?

The Chairman replied that if they cleared themselves from the Lane-Fox licence the Hammond Company would supply this company with lamps of that description which they might require, merely as a matter of trade, so that they would not thus lose the power of supplying the Lane-Fox lamp by giving up the licence.

Mr. Macallister remarked that it had now been discovered, so it appeared, that the lamp was the only thing valuable to this company, and that they had really the *exclusive* right. If the lamp was thus so valuable why should they give it up? (Ironical laughter.) What were the shares offered worth? Who could they get to assess them? He held still, as he had always, that the board had no right to allot upon the capital subscribed. They were now some time in existence, yet they knew nothing of their financial position.

Mr. Hammond: You say the shares are worthless. I will buy them at that price. (Laughter.)

Mr. Macallister said when he applied for his money he did not know there was insufficient application. He got an allotment instead of his money. He had £1,000 in the company and did not intend to lose it. What did the vendors give up? Why, the chance of receiving a problematical dividend.

Mr. Hammond said the question had been asked, Why do not these people give us back cash? The fact was that they were sufficiently enthusiastic when the company was started to invest all the money they had in the company. The whole cost of floating the company and the £5,000 paid to the Hammond Company was now represented in their pockets in shares. They had an opportunity of walking off with £50,000, or, if they felt disposed, of investing it in the company. And who was to blame? By the agreement the directors had no option but to allot. He had considered all along that a margin of £25,000 was sufficient to work the Yorkshire business. When the Hammond Company came out they thought £45,000 free capital was sufficient to conduct the whole of the business for the whole of its concessions; and should it be said that for the business of the Yorkshire Company £25,000 was not sufficient?

Mr. Macallister: Why was so much as £200,000 asked for?

Mr. Hammond: The directors were empowered to proceed to allotment on £25,000 free capital, and they got it. The Hammond Company and the Yorkshire Company were one in endeavouring to promote their respective interests, and his own opinion was that the way to get the Ferranti dynamo was to get rid of the Lane-Fox lamp. He was in Middlesborough the previous day, and was distressed to hear so many queries about the Lane-Fox lamp. The Hammond Company were by far the most interested parties in the progress of this company; and if they could they would like to get rid of all the difficulties which surrounded this lamp. On the one hand they had Mr. Whiteley, and perhaps his difficulty was no difficulty at all. If Mr. Brown's statement were true, why give away their licence. But it would be better, if they could see their way, to say they were untrammeled by the lamp question. A profitable contract had been placed before the company from Leeds. He was perfectly confident, on the figures, that the order must come to this company, and if it did not, it would be on account of their pending legal position. It was a most vital thing that that order should be got. If they got that, there was a prospect of an extended order up to £50,000. He was therefore very anxious that the order should come to that company. Mr. Ferranti, who was himself in Yorkshire on Thursday, would use his influence towards getting the order for this company; but that order was just likely to go past this company in consequence of their not knowing how they stood in regard to the Lane-Fox. Would it not be well to settle the matter if possible by parting with some of their shares. The rest would be valuable, and he believed in a dividend. They would get a proportionately larger dividend on their reduced shares. He was more and more convinced of the immediate future there was for the electric light, in spite of the view taken of it by the London market. He had seen very much in the manufactories in the north what a boon the electric light was going to be to the workmen. It was a light which did not rob the air of its oxygen, and it enabled better work to be done than by the aid of gas. He knew one manufacturer with 200 gas burners, who spoke of a gas bill of £500 a year. Electric lighting must be much cheaper than that. Now with regard to their Brush property. It had been urged that the Ferranti machine was described as a better machine than the Brush, and practically made the Brush obsolete. They had wanted a machine to run 500, 1,000, or 5,000 lights, and in the Ferranti machine that was possible. The greatest weakness of the Brush was the absence of an incandescent machine. The thing they had before them now, the Ferranti, was an incandescent machine. The Hammond Company, who were the holders of the Ferranti, were the greater holders in this company. He was delighted to hear they had offers in Leeds and Sheffield, for the Yorkshire Company would have all the help the Hammond Company could give it.

Mr. Maynard, one of the board, remarked that Mr. Stobart seemed to think they were going to get nothing for that for which they had paid cash. They were going to give away, if it must be so called, that which did not now appear to be of great value to them. The company did not pay cash for the Lane-Fox alone. They gave the cash for the two together. The value of that purchase, so far as they had yet gone, appeared to him to lay in the Brush and not in the Lane-Fox. He had had nothing to do with the ins and outs which had been mentioned by Mr. Guadella. The Brush light had been his faith in this matter. He was convinced they had a good future before them, and he had said so at every meeting. This rupture in this business had given him very considerable anxiety. He had been accustomed to be associated with things that were successful. But this matter had given him and his colleagues much anxious care because of the action taken by certain of the shareholders, which action had been signally detrimental to the future of this company, which might have been very successful if all had gone on smoothly. Now they had come to the offer which had been made, and he confessed, for his own part, he was not prepared to receive shares only. He was a shareholder with the rest of them, and had taken more than his qualifying number. He had a resolution to move in the following terms: "That this meeting empowers the directors to conclude the transfer of the Lane-Fox licence to the vendors for the sum of £30,000 in shares and £5,000 in cash."

Mr. Hastings seconded the motion.

Mr. Ince suggested that the resolution should be left with power to the directors to alter the terms.

Mr. Hyman asked whether, if they passed Mr. Maynard's amendment, there was any probability of such terms being accepted? If not, they would be left in the same position as at present.

The Chairman replied that they were supposed to be there *in camera* to elicit from the shareholders their opinion upon the proposal made. The feeling was all through that cash payment should be made with the shares. If the resolution were passed by the meeting, he thought himself that it was so nearly the proposition made to them that the Electric Works Company would accept it. If they did not they could only show they had done their best.

Mr. Guadella said the offer was made either to be received or rejected. The vendors had received no cash, neither would they pay any. He was commissioned not to vary the offer one iota. It was well that shareholders should know that.

The Chairman: If the majority of the shareholders express an opinion in favour of part payment in cash, we ask for power to be able to negotiate. This gentleman says cash payment will not be made.

Mr. Hyman said it seemed to be a question whether they would be left with the Lane-Fox or whether they would have £35,000 in shares. Let them decide at once; they would be no nearer if they did not, and would have to call another meeting.

Mr. Stobart remarked that the Electric Works Company appeared to have no money to pay with, so he proposed that they accept the offer.

Mr. Ince said he was rather anxious that they should get free from the Lane-Fox licence, whether exclusive or otherwise, for they would probably then get a better dividend on their reduced share capital. He was afraid if they did not rid themselves of the licence that they would be left with the Lane-Fox light and the full capital to pay dividend on. He had seen the capital station of this company at Middlesborough. The forty lights capable of being run from the dynamo there were all being rapidly taken up. It was clear to his mind that a short time only must elapse before all the lights they could supply would be taken up, and that they would have to put down further power and increased dynamos. The money paid for these lights alone would be sufficient to cover the working expenses of that station. If they could get 200 arc lights, that alone would pay a dividend on the reduced capital.

The Chairman then put the offer, both as an amendment to Mr. Maynard's proposition and as a substantive motion. It was carried.

Mr. Hyman: The Ferranti machine can be used by our company?

Mr. Hammond: Yes, sir.

A vote of thanks to the Chairman for presiding, proposed by Mr. Guadella, concluded the proceedings.

The Railway and Electric Appliances Company (Limited).

AN extraordinary meeting of the above company was held on Wednesday last at Cannon Street Hotel, under the presidency of the Duke of Manchester, for the purpose of considering a proposal to acquire a certain interest in the engineering works of Messrs. Latimer Clark and Muirhead.

The Secretary, Mr. Skinner, having read the notice convening the meeting, the Chairman said: Gentlemen, the object of this meeting is to ask you to sanction an agreement between Messrs. Latimer Clark and Muirhead and this company. I am sorry to say that the negotiations have not been completed as to certain details, and therefore we cannot put before you a definite agreement for your sanction and approval. We should however state to you, and I hope you will find them satisfactory, the general grounds upon which we are negotiating. No doubt the name of Messrs. Latimer

Clark and Muirhead are well known to you. They have a good reputation as manufacturers of electric and telegraphic appliances, and they are also well known in scientific circles. We have this morning, as showing the large business they are doing, a note which states that they have lately put tenders in to the amount of £100,000, from which no doubt, if they get them, they will expect a very large profit to be derived. They have orders now in hand to the amount of £20,000 or £30,000, and this morning they have inquiries for a matter involving a considerable amount—£25,000. They can undertake all electric and telegraphic business, so that if we joined them we should be stepping into a very important business. They have works in Regency Street, Westminster, which I have visited and found in full operation, doing very excellent work. They have acquired also very extensive premises at Millwall, near Northumberland Docks, and where they propose to erect very large works. In fact it would be necessary to have very extensive works to carry out all the business they are anticipating. With regard to the heads of the agreement, I had, perhaps better divide them into two points: firstly, the premises and plant and stock we take over, and secondly the goodwill of the business. With regard to the premises, plant, and stock, Mr. Wildy is investigating the value at which we may agree to take them, if we see it to be for the interests of the company to make a bargain. The sum to be paid for that will be a first charge on the profits of the business to the extent of 7 per cent. It is proposed to pay cash for the stock by quarterly instalments spread over two years. Those sums will be a first charge of 7 per cent. on the profits. We should receive 7 per cent. on all the capital expended in that way before any division of profits takes place between Messrs. Latimer Clark and Muirhead and ourselves. In payment of the goodwill of the business we are to give them £10,000 in fully paid-up shares and two-fifths of the net profits of the business, this company having the other three-fifths. That is, we get 60 per cent. out of the net profits of the balance, and Messrs. Latimer Clark and Muirhead get 40 per cent. In consequence of our not having definitively settled the agreement, we must ask for discretionary powers to agree to or modify this agreement as we may see fit. If you have confidence in us as directors I am sure you will consider yourselves safe in our hands. If you give us these discretionary powers we shall endeavour to exercise them in the interests of the company (hear, hear).

Mr. Vallance, solicitor to the company, then read an abstract of the proposed agreement, which traversed the same ground as the chairman's speech. A condition annexed was that Mr. Latimer Clark should qualify to become a director, and if elected should receive no other payment save the usual director's fees. The company were to take over liabilities of existing contracts.

Mr. Edmondston complained that the information presented was a little meagre. For instance, they had not been told what the proposed acquisition would cost, nor anything about what that well-known firm was now earning. There was also in the agreement an important paragraph to the effect that the company took over all liabilities on existing contracts. He had been connected with a company which took a contract in a similar way, and that had been a heavy loss to them ever since. The address of the chairman had struck him by its having no allusion to what they had already done. This company had been established with the enormous sum of £95,000, and it was not worth a third of that money. Personally he did not feel very extreme confidence. When electric lighting was in such a transitional state, he did not think it was a good time to acquire machinery, which might become obsolete presently, and they were also surely entitled to know a little about the past before any fresh step was taken forward.

The Chairman said that those points as to their future relations with the new firm was just one of the matters in question between them, which Mr. Wildy was investigating, and which they had hoped to be settled and arranged before this meeting. Mr. Wildy had not yet been able to make out the profits of the last year, as the books of the firm were only just settled. But Mr. Wildy was pretty well satisfied that the profits had been considerable. With regard to plant and materials, the case was just the same. As to contracts, Messrs. Clark and Muirhead were under agreement with the Australian Brush Light Company, under which it was necessary to put up lights in Australia. That contract, therefore, would be excluded from the agreement, and the other contracts were merely orders. The orders were handed over, and there was an end of responsibility.

Colonel Raynsford Jackson would like to know whether Messrs. Latimer Clark and Muirhead would share in the losses as well as the gains. How long would that partnership to the extent of two-fifths of the profits subsist? Were the buildings to be taken over at cost or at valuation, and how were the machinery and plant to be taken over? Could the Chairman give them in round terms an idea of what the whole purchase would involve? Did they feel confident that they could carry on the business successfully without making a call on the shareholders (hear, hear)? Was there anything in any of the remaining contracts that ought to be explained to the shareholders? Were there no contracts which would continue for any lengthened time, or were there any liabilities out of the ordinary course? He must not be understood as in any way hostile to this arrangement if it could be satisfactorily carried out so as to meet the requirements of sound commercial men. One of the main difficulties of the electric companies floated during the past twelve months had been that it was difficult to get commercial men who were at the same time scientific men and understanding mechanism. Now this proposed arrangement would secure men of known ability, and thus the interests of the company might be subserved by this arrangement with Latimer Clark and Muirhead.

The Chairman said that the directors had considered that a call at the present time would be injudicious, and therefore in their contemplated arrangements they did not consider a call necessary (hear hear).

Mr. Wildy said that all the contracts had been submitted to him, and he could find nothing in them at all objectionable nor involving any liability of a serious character. The obligations seemed to be all on one side. The firm had contracted with certain parties that they should give them the option of supplying electric apparatus on definite terms. If Messrs. Clark and Muirhead neglected or declined to supply it, then these parties were free to deal with any other firm they chose. As to capital required, when the matter was first brought before the board, it was stated that the capital would be £20,000 to £30,000, for stock, machinery, plant, and working capital, assuming the company to carry on their work on the same lines as the vendors. It would be a great mistake to take the whole thing at a valuation, which meant an unknown quantity. A fair basis of arrangement was the cost price, with an allowance for depreciation. As to premises, they thought it was desirable that a company should not at the outset buy a building out and out, but take it at a fair rental. Millwall was freehold, bought at a price exceptionally low. They proposed to give such an amount on that as rental as would make 6 per cent. on the actual cost value; but if they at any time desired to sell it the firm was to have the option of purchase.

Colonel Jackson asked what sum was to be actually found for the plant, separately.

Mr. Wildy said that perhaps about £10,000 would be needed. The whole amount required to be paid in quarterly instalments would be perhaps £15,000. The company had the option of buying the premises within five years. They could also buy such plant at Millwall as they required for the price which the vendors gave for it, less depreciation, which they considered very much below the market price.

In answer to a shareholder the Chairman said that the business in Glasgow would be continued as at present. It would be quite disconnected with their present proposal.

Mr. Wildy, continuing, said that he thought they might anticipate about £15,000 a year as a reasonable figure for the profits. Taking that amount as a basis, the company would receive £2,100 as their 7 per cent., and then £7,740 as their 60 per cent., thus giving £9,840 to them and £5,160 to Messrs. Latimer Clark and Muirhead, so that really the company obtained two-thirds of the profits and the vendors one-third.

General Goodenough suggested that an investigation ought to be made into more than one year's profits (hear, hear).

Mr. Wildy said he was proceeding on the basis of three or four years' balances.

Mr. Vallance, replying to a further question, said that the parties with whom the Clark and Muirhead firm had contracted had undertaken to deal with them at a certain low price—from five to twenty per cent. only being added to the actual cost; only if these firms sold again the Clark firm stepped in and obtained a further share in their profit.

Mr. W. A. Smith, of Glasgow, said that that arrangement enabled the parties with whom the firm contracted to take installations at a low price. As to the Glasgow works, they had centralised the two distinct works which they had originally obtained, and they had done what they could with their opportunities. They had consistently avoided all through installations on fine bargains, or for free supply of lights. Some companies had undertaken contracts over which they had lost thousands, through being told in a month or two that they were tired of them. They ought to rely more on their railway appliances than they had been doing. He was satisfied that they had a future before them; their appliances would be a real saving to any company that adopted them, and a source of safety to the passengers.

Mr. Edmonston asked whether anything could be done with regard to the £95,000 originally paid, which he held to be a great over-payment. Could the parties who received it be made to disgorge?

The Chairman said he did not admit that they had made a bad bargain; but the money had been paid, and he did not see what could be done further.

Mr. Smith said he might add that arrangements had been made by which, without additional payment, the patent rights for their appliances had been secured for the Indian Empire and the colonies, excluding Canada.

The Chairman then put the resolution to sanction the conditional agreement, which was seconded by Sir Edward Inglefield.

Mr. Alfred Keene was understood to object to the resolution on account of the lack of information which had been given.

The resolution was carried by 22 votes to 1. Mr. Keene being the dissentient.

The Chairman: Part of our arrangement with this firm is that Mr. Latimer Clark should be on our board. We are at present full. Under the Articles of Association we can only have seven on the board, so that we have no room. We therefore ask for you to alter the Articles of Association to the extent of increasing the number of directors as far as twelve. We propose, therefore, that the 63rd Article of Association is to be altered by substituting 12 for 7.

Lieutenant-Colonel G. A. Elliot seconded the motion, which was carried by 22 to 1.

A vote of thanks to the chairman was then carried on the motion of Colonel Raynsford Jackson, seconded by Sir Edward Inglefield, and the meeting terminated after the chairman had briefly acknowledged the compliment.

The Eastern Telegraph Company.—We have received a copy of the Tariff Book issued by the Eastern Telegraph Company (Limited). It contains ten well-executed maps in colours, showing the company's system and its general connections. The matter, amounting to 31 pages, gives amongst other items a list of stations in no less than 18 foreign states, the rates for telegraphing from England to any of the company's stations abroad, and several other points of interest. Books of forms, tariffs, &c., are forwarded post free on application to the company's chief offices, 66, Old Broad Street, London.

PATERSON & COOPER
(LATE EDWARD PATERSON),
ELECTRIC LIGHT & POWER & TELEPHONE ENGINEERS,
St. Paul's Works—76, LITTLE BRITAIN, LONDON, E.C.,
AND
European Telegraph Works—POWNALL ROAD, DALSTON.
Prize Medals, International Electrical Exhibitions, Paris, 1881, and London, 1882.
MANUFACTURERS OF
DYNAMO MACHINES, ARC LAMPS, SWITCHES,
AND ALL FITTINGS FOR ELECTRIC LIGHT INSTALLATIONS.
SOLE MAKERS OF AYRTON AND PERRY'S ELECTRIC CURRENT METERS.

AYRTON & PERRY'S
Ammeter.
Ohmmeter.
Power Meter.
Voltmeter.
Eidsforth's
K. E. Switches.

Telephones.
Transmitters.
Switchboards.
Batteries.
Insulators.
Magneto Call Bells.
Electric Signals.

MUDFORD'S IMPROVED THOMSON'S REFLECTING GALVANOMETER.
SPECIAL ELECTRICAL TEST INSTRUMENTS FOR ELECTRIC LIGHT COMPANIES.

ELECTRIC LIGHT LEADS, GUTTA-PERCHA, INDIA-RUBBER COMPOUND BRAIDED COTTON, SILK-COVERED WIRES.

SPECIAL WIRES FOR DYNAMO MACHINES.

PHILLIPS BROS.,
ELECTRICAL WIRE MANUFACTURERS,
MACINTOSH LANE, HOMERTON,
LONDON,
AND AT THE LEA TELEGRAPH WORKS, HACKNEY WICK.

ESTABLISHED 1870.

SPECIAL WIRES FOR INCANDESCENT LAMPS.

GERMAN SILVER WIRES FOR HIGH RESISTANCES, FLEXIBLE CORDS, TELEPHONE WIRES, &c. &c. MULTIPLE, AERIAL, AND SUBTERRANEAN CABLE WIRES TO ANY SPECIFICATION.

INDIA-RUBBER, GUTTA-PERCHA, & TELEGRAPH WORKS COMPANY, LIMITED.

Offices and Warehouses: 106 & 100, CANNON STREET, LONDON, E.C.
Works: Silvertown, Essex; Persan-Beaumont, France.

TELEGRAPH ENGINEERS & MANUFACTURERS

OF

CABLES.—Submarine, Subterranean, and Aerial.

WIRE.—India-Rubber and Gutta-Percha covered in all gauges.

INSTRUMENTS.—"Morse" Inkers, Single Needle, Wheatstone's Alphabetical, Semaphore "Block" Instruments, Bells, Resistance Coils, Sir W. Thomson's and other Galvanometers, Condensers, Testing Instruments, &c.

BATTERIES.—SOLE MANUFACTURERS FOR GREAT BRITAIN, IRELAND, AND THE COLONIES OF THE CELEBRATED LECLANCHE BATTERY, which has received the most favourable reports from the Postal Telegraph Authorities and other eminent Telegraph Engineers, and is now in general use by the Post Office and English and Continental Railways. As a Battery for all Telegraphic purposes it is undoubtedly pre-eminent. All other kinds of Batteries also manufactured. Ebonite Cells, Carbon Plates, &c.

INSULATORS.—Ebonite, Porcelain, Brownware, &c.

MANUFACTURERS OF THE MOST IMPROVED APPARATUS FOR **RAILWAY BLOCK-SIGNALLING.**

SEMAPHORE REPEATERS, "LIGHT" INDICATORS, AND WALKER'S "PASSENGER AND GUARD" COMMUNICATOR.

TELEGRAPH STORES AND APPARATUS OF EVERY DESCRIPTION.

TORPEDO APPARATUS.

THE INDIA-RUBBER, GUTTA-PERCHA, AND TELEGRAPH WORKS COMPANY (Limited) are Patentees and Manufacturers of a Complete System of Torpedoes for Harbour and Coast Defence, and of the

SILVERTOWN PATENT FIRING BATTERY.

A Constant Battery for Mining and Blasting Purposes.

CONTRACTS ENTERED INTO for the SUPPLY, CONSTRUCTION, and MAINTENANCE of TELEGRAPH LINES.

MANUFACTURERS OF

VULCANISED INDIA RUBBER.

Valves, Sheet, Buffers, Springs, Washers, Wheel Tyres, Cord, Tubing, and Door and Carriage Mats.

INDIA RUBBER AND CANVAS SUCTION AND DELIVERY HOSE.

India Rubber and Canvas Steam Packing—Round, Square, and Sheet.

INDIA RUBBER MACHINE DRIVING BANDS.

WATERPROOF GARMENTS AND FABRICS:

Coats, Capes, Leggings, Hats, Helmets, Knee Wrappers, Diving Dresses, Sheeting for Hospitals, Water and Air Proof Beds, Pillows, Cushions, Bottles, Baths, Life Belts, Gas Bags.

EBONITE.

Not affected by Vinegar or Hydrochloric or Acstic Acid.

Pumps.
Photographic Articles.

Speaking Tubes, Mouthpieces.
Battery Cells.

Sheet and Rod.
Surgical Appliances.

GUTTA-PERCHA.

Tubing, Belting, Buckets, Bosses for Flax Spinning, &c.

Works: SILVERTOWN, ESSEX, LONDON, E.; PERSAN-BEAUMONT, FRANCE.
London Office—106, CANNON STREET, E.C.
Warehouse—100, CANNON STREET, E.C.

BRANCHES:

LIVERPOOL	52, Castle Street.
GLASGOW	20, Dixon Street.
BRADFORD, YORKSHIRE	35, Kirkgate.
SHEFFIELD	10, Castle Street.
PORTSMOUTH	49, High Street.
BELFAST	33, High Street.
DUBLIN	15, St. Andrew Street.
BRISTOL	37, Corn Street.
NEWPORT, MON.	82, Dock Street.
CARDIFF	Pierhead Chambers, Bute Docks.
NEWCASTLE-ON-TYNE	21, Grainger Street West.